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Investigating public libraries' preparedness for the Fourth Industrial Revolution: a case study of the National Library of South Africa, Pretoria

By

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DECLARATION

I, Mbalenhle Lucia Kekana, declare that:

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Signed: 

Signed: ... 

Date: 08 

Date: 11 December 2023

DEDICATION

This dissertation is dedicated to my loving Mother, Mrs Bella Elizabeth Kekana, who has supported and encouraged me throughout my studies. For being an advocate of education and excellence in my life, I would not have been the person I am today without YOU.

Thank you for your unmeasurable support and encouragement Mama. This is for you, Mother.

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ABSTRACT

The Fourth Industrial Revolution (4IR) is an important emerging sociological phenomenon that has the potential to reconfigure libraries, societies and people throughout the world. The 4IR introduces technologies and trends such as the Internet of Things (IoT), virtual reality, robotics and artificial intelligence. The introduction and popularization of the 4IR has challenged the traditional thinking of libraries as physical or brick and-mortar locations where access to information is available in a physical or electronic format. The shift into the 4IR has challenged libraries to adapt to the changing technologies, where access to information can be efficient, quicker and easier. Scholars and researchers have discussed the 4IR technologies in libraries and have alluded to the need for proactive libraries to respond to the 4IR. The study aimed to investigate the library's preparedness in anticipation of the 4IR, using the lens of the National Library of South Africa (NLSA). The subject of analysis was the staff of the National Library, which included the library management staff and librarians knowledgeable in technology use at the National Library. The study was guided by the Technology Readiness Index (TRI). The pragmatism paradigm was employed, using quantitative research methods to draw both numerical and narrative approaches. Data was collected using a questionnaire and a semi-structured interview schedule. Data were analyzed through content analysis and the use of SPSS (Statistical Package for Social Science) software descriptive analysis and presented in the forms of figures. It was found that most respondents believe that 4IR might be essential to improving and making tasks easier for librarians. The results contrast with the popular belief that librarians reject the tools. The respondents are optimistic about the 4IR although skeptical about the innovations of the revolution. It was also discovered that challenges such as inadequate infrastructure, lack of funding, unstable electricity supply, inadequate skills and lack of exposure to international standards hinder technology preparedness. In addition, the study contributed to strategies, policy developments, adequate preparation and practice and also added to the existing knowledge of 4IR.

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LISTS OF ACRONYMS

AI	Artificial Intelligence
DSAC	Department of Sports, Arts and Culture
ICT	Information Communication Technology
IoT	Internet of Things
IT	Information Technology
TAM	Technology Acceptance Model
TRI	Technology Readiness Index
UKZN	University of KwaZulu-Natal
UTAUM	Unified Theory of Acceptance and Utilization of Technology
4IR/4.0	Fourth Industrial Revolution

CHAPTER ONE: INTRODUCTION TO THE STUDY

1.1 INTRODUCTION

With the emergence of a new revolution, the 4IR, humankind is faced with a new dawn in technology transformation, a transition from electronics and information technology (IT) into a digital revolution. This revolution involves artificial intelligence (AI), drone delivery, robotics, self-driving cars and more. These advances have opened up a world of new discoveries in technology that are changing our way of living, working and interactions with one another (Hussain, 2020).

The introduction and popularisation of the 4.0 by the World Forum, has challenged the historical thinking of libraries as a solid or brick locations at which access to information is available in a tangible or electronic format (Botha, 2020). The shift into the 4IR also challenges libraries to adapt to the changing technologies, where access to information can be efficient, quicker and easier. The study investigated public libraries' preparedness in anticipation of the 4IR, using the NLSA as its case study. The feasibility of public libraries in South Africa deploying and using 4IR at the current moment is low. Consequently, a study of the NLSA can provide a 4IR framework to guide public libraries. Although the NLSA is not a public library, it was nevertheless chosen as a case study because it has a broad mandate and the infrastructure for possible implementation and rollout, and therefore functions as a model for public libraries to follow. There has always been an interconnection between public libraries and the NLSA.

To further fortify the connection between public libraries and the NLSA, the Department of Sports, Arts and Culture (DSAC) allocated R1.8 billion (designated as conditional grants for public libraries in the period of 2007-2008 for development of libraries for the years 2014 and 2015 (NLSA, 2014). Further evidence of the relationship between public libraries and the NLSA is demonstrated by projects such as Bill and Melinda Gates Foundation through its global libraries project in South Africa. The project was dedicated to partnering with the Bill and Melinda Foundation and the NLSA with South African public libraries, mandated to implement computers and electronic data to various communities (NLSA, 2014). This project is active in all the 9 provinces of South Africa. It aims to expand digital resources drawing on the funding of R32 million provided by the foundation and the NLSA (also named the online Mzansi libraries project). The project provides free access to the internet as well enhances and

strengthens ICT (Information Communication Technology) equipment in public libraries for all South Africans (NLSA, 2014; Frankston, 2015).

This chapter begins with a brief background on libraries and the 4IR. This is followed by the problem statement, which explains what motivated the researcher to conduct this study. The research project's aim and objectives, and key research questions are clearly stated, including the theoretical framework, study's significance, delimitations, research designs and methods.

1.2 BACKGROUND OF THE STUDY

The 4IR is an emerging sociological occurrence that has the potential to change societies and people throughout the entire world in ways that have not been experienced before (Carrim, 2022). The 4IR introduces technologies and emerging developments like virtual reality and the internet of things, robotics and artificial intelligence. The integration of these technologies stems back from the first industrial revolution in the 18th and 19th centuries, which introduced the transition from agrarian societies to the industrialisation of other technologies, including the steam engine inventions (Moshimane, 2021). The industry saw the creation and growth of the canal and later railway networks which improved communication abilities, and the stock exchange (Kayembe & Nel, 2019). The second technological age, was driven by electricity and included the expansion of industries, mass production, steel and chemicals (Davis, 2016). The third industrial revolution was the digital revolution, which started in the mid-20th century, characterised by advancement of technology, computers, the internet and ICTs (Jabur, 2019).

The 4IR is described as the fourth major industrial era, in which technologies are fused in the physical, and digital worlds, impacting various disciplines, including economies and industries (Gastro, 2020). According to Schwab (2017), the 4IR includes and is not limited to AI, robotics, IoT, third dimensional printing, smart sensors, augmented reality (AR), quantum computing, cognitive computing, big data/analytics, and block chain. The 4IR mostly focuses on AI and automation, altering gradually how people interact, work and live (Hussaian, 2020). Various trades and industries have started gradually to be affected by the 4IR and as a result, changing business models and employment trends. Today, libraries around the world and in South Africa are affected by different elements of the 4IR in one way or another. They currently use new lenses for new opportunities and possibilities in the 4IR (Hussain, 2020). In South Africa, AI and robotics have emerged at university libraries. For instance, the University of Pretoria began

using a well-known robot, called Libby in 2019, which according to Van De Walt, is a new library employee who is originally from China (Ocholla & Ocholla, 2020).

Libraries are gradually advancing a variety of technologies in order to achieve library 4.0 goals and are at the moment described as intelligent systems, context-cognisant technology, open space, big data, cloud service, augmented reality and librarian 4.0 (Noh, 2015). The development of the 4IR technology is demanding libraries to improve the service systems to serve the communities quickly and accurately (Andi, Taufiq & Sokhibul, 2018). Therefore, libraries need to be prepared for the transformational changes that technology brings, such as the new 4IR technologies that are gradually finding their way into industries. Being prepared enables an effective response when needs occur (Mafro & Barteye, 2010). Libraries' preparedness means that library managers, librarians, and users need to update their expertise to offer efficient services connected to the Fourth Industrial era (Nwaohiri & Nwosu, 2021). Hence there was a need to investigate the preparedness of the NLSA, Pretoria, for the 4IR.

Nikiko and Okuonghae (2021) state that it would equate to lack of development, any library that is not in a hurry risks obsolescence and stagnation to mainstream trending technologies and opportunities by the dynamic forces prompted of the current trends and other compelling features of the 4IR. However, there are many challenges that libraries (public, special, academic) encounter that hinder any technological development, thus making it hard to keep up with innovative technology. The lack of funding remains an obstacle for some libraries in procuring sustainable resources, poor, subsequent unreliable and ineffective telecommunication infrastructure. The other issues are; lack of Information Communication Technology (ICT) skills to utilise web 2.0 tools and IT specialists in libraries to maintain automated systems. Additional issues are; staff's resistance to change and inadequate digital literacy skills (Fourie & Mayer, 2016; Ash & Wilmot, 2015; Emmanuel, Ebiaghe & Godfrey, 2013; Nikiko & Okuonghae, 2021). The NLSA in Pretoria encounters similar challenges. It is reported in the NLSA Annual Report (2020-2021) that some ICT elements cannot be maintained due to the lack of funds. The insufficient funding challenge contributes to the incapacity of the ICT division to implement specified business improvement projects, thus contributing to the failure to provide much needed training for skills development for ICT system operators (NLSA Annual Report, 2020-2021).

The 4IR is powered by certain technological advancements such as: big data, robotics, virtual and reality, AI, augmented reality, security systems and the IoT (Hawthorne, 2019). This

led to the product and services digitisation growth, which is named the omnipresent internet (Nwaohiri & Nwosu, 2021). In the library environment, these tools and applications can boost productivity in libraries, reduce costs and enhance the standard of products and services (Nwaohiri & Nwosu, 2021). In accord with to the World Economic Forum (2016); Golub and Hansson (2017), libraries can use 4IR technologies such as big data, the IoT and AI to boost productivity and make wise decisions. The application of data analytics can be used to increase awareness to understand user's preference, adapting market circumstances and increase effectiveness in the library (World Economic Forum, 2016; Golub & Hansson, 2017). However, several uncertainties and challenges still persist (Nankervis *et al.*, 2021; Botha, 2020). For instance, the level of preparedness of the libraries (public, academic, special) for the 4IR is unknown (Ogunlela, & Tengeh, 2021).

Accordingly, the current study relied on the NLSA to determine how ready public libraries are for 4IR. The NLSA is a foremost institution that provides leadership due to its core mandate, mission, functions, expertise, infrastructure, staffing, resources, and partnership to provide a blueprint for public libraries and others. Furthermore, an initial exploratory study of the public library landscape revealed the limited feasibility of developing and using 4IR. Consequently, leveraging the preparedness of the NLSA was considered necessary as a model to cast light on the adoption and use of 4IR in public libraries as a research nexus between institutions in the library landscape. Equally, the evolution of the workforce concerning the perceptions, fear, and apprehension of staff (librarians) - for the 4IR demand scholarly analysis (Rotatori, Lee, & Sleeva, 2021). This study investigated the NLSA, because the provision of technology implementation in South African libraries is still occurring on a limited scale (Marmathole & Fomba, 2018).

1.2.1 BRIEF BACKGROUND OF THE NLSA

According to the NLSA (2021), the institution is the keeper of South Africa's collection of national heritage documents and the country's national repository for published resource materials. The institution governed by the National Library Act of 1998, that stipulates its national mandate, motive, function and administration provision (Ralebipi-Semela, 2015). The NLSA is required by the NLSA statute mandates collection and preservation of published resources and make them available as well as accessible to all South African citizens ensuring that knowledge is not lost to posterity (NLSA, 2021). Ralebipi-Semela (2015) states that the NLSA, as known today, was formed on 1 November 1999 as a result of the merger of the two

national libraries, namely: The South African Library in Cape Town and the National Library in Pretoria. The collections of the NLSA consists of a wealth of information, which includes rare manuscripts, books, periodicals, government publications, official foreign publications, maps, technical reports, Africana and newspapers which are published in South Africa (NLSA, 2021).

According to Tsebe (2010), the NLSA's basic operations include building a total assortment of published resources originating or pertaining to South Africa; maintaining and extending any other collections of records, both published and unpublished, and accentuating papers originating in or pertaining to Southern Africa. The NLSA also encourage management of collections of all published resources in South African libraries. The institution renders a country-wide bibliographic service and encourages effective access to published documents on a national and international level as the national bibliographic agency. It also provides reference as well as information services, for both nationally and internationally, and acts as the country's preservation library and provides protection services of documents on a national level. Lastly, the NLSA promotes awareness of the nation's body of polished documentations; and promotes information literacy and information awareness.

The NLSA has a vision to be an exceptional African national library and information centre (NLSA, 2021). Its goal is to build, record, preserve, conserve the nations heritage and make it available to all South African citizens and foster a reading and informed citizenry (NLSA, 2021).

1.3 PROBLEM STATEMENT

The 4IR is here and its development affects every aspect of human engagement (Hussain, 2020). Industries are greatly affected by the 4IR; applications into new skill sets matching up to the revolution are gradually introduced. Libraries cannot be excluded as they are also greatly affected by the revolution; libraries are changing representatives of the 4IR, and if they are not prepared, they will face a number of problems (Hussain, 2020).

There is a need for librarians to come to light and also be prepared to acquire necessary expertise of the 4IR. Libraries need to be prepared to implement the innovative technologies. Preparation is essential to enable effective planning for innovation, effectively weigh the advantages and disadvantages ahead of implementation. Preparedness enables the ability to take advantage of future production opportunities, reduce risks, sustain a high staff morale and combat challenges, and be tough and nimble in responding to unknown uncertainties (Olutoyin,

Issah & Wayi, 2021). Staff attitudes and perceptions are elements that can significantly affect the implementation of technology in organisations, posing challenges to technology adoption (Ramzan, Asif & Ahmad, 2021). Therefore, library preparedness means libraries need to embrace transformational changes, prepare staff mind-sets, learn and explore new skills (Mafumana, 2019). Ahmat and Hanipah (2018) also add that for libraries to transition into the 4IR effectively, library leaders need to support library staff to participate collectively and prepare for the 4IR. Libraries that struggle to understand and embrace these trending technologies may be left behind; therefore, libraries should keep on level of emerging technology trends to serve patrons better (Lund, 2021).

The NLSA Bill of 1998 mandated the institution to be transformed and be responsive effectively to information needs of South African citizens, and adapt to changes that are brought about by 4IR technologies (Mtsali, 1999). It is therefore crucial to investigate the NLSA staff's preparedness, perceptions and challenges amidst the 4IR revolution era. In literature there is a gap that describes the preparedness of 4IR at the NLSA, thus making it difficult to ascertain if the NLSA is prepared for the 4IR revolution. The literature by (Ahmat, 2018; Marwala, 2019; Ocholla & Ocholla, 2020) touch on the need for reactive libraries to respond to the 4IR era. Ocholla and Ocholla (2020) state that the concept of 4IR is limited in the literature relating to libraries. Du Plessis, Gumede (2021) explain that scholarly investigations onto the 4IR and the Library Information Science (LIS) sector grows at a minimum of 2.8% on an annually. Arifin *et al.* (2019), Ocholla and Ocholla (2020), and Nwaohiri and Nwosu (2021) conducted studies on the 4IR in school and academic libraries. There lies a need to extend the exploration to the landscape of national libraries; hence, the need for the study to fill the knowledge gap. The study aimed to investigate the public library's preparedness for the 4IR, using the NLSA in Pretoria as a case study.

1.4 AIM AND OBJECTIVES OF THE STUDY

The study aimed to investigate public libraries' preparedness for 4IR through the lens of the NLSA, Pretoria. The study's research objectives were to:

1. Ascertain the preparedness of the NLSA, Pretoria in adopting the 4IR.
2. Investigate perceptions of librarians of the use of the 4IR technology at the NLSA, Pretoria.

3. Identify challenges to the preparedness of the NLSA, Pretoria for 4IR.

1.5 KEY RESEARCH QUESTIONS

The primary inquiry for the study was:

How prepared is the NLSA, Pretoria, to adopt the 4IR (4IR) to enhance library efficiency and effectiveness?

The specific research key questions addressed were:

1. How prepared is the NLSA, Pretoria, for the 4IR?
2. How do librarians at the NLSA, Pretoria, perceive the use of 4IR?
3. What are the perceived fears and scepticisms of librarians towards adopting the 4IR technologies at the NLSA, Pretoria?
4. What are the challenges to the preparedness of the NLSA, Pretoria, for the 4IR?

1.6 THEORETICAL FRAMEWORK

The theoretical framework that guided the study is the Technology Readiness Index (TRI). TRI is a 36-item scale that measures people's tendency to welcome and use new advanced technologies; it was published in the *Journal Service Research* over a ten years ago. Parasuraman developed the theoretical framework in 2000, which Parasuraman and Colby later modified in 2015. The theory is now a 16-item scale known as the TRI 2.0, with the identical TRI content, structure and psychometric traits. TRI indicates a composition of mental motivators and inhibitors that determine a person's ability to use new technology (Parasuraman 2000, p. 308). The following assertions about technology are the foundation of TRI 2.0 (Parasuraman & Colby, 2015; Parasuraman, 2000, p. 308): Optimism refers to the positive look on technology, the conviction that it can help people live more independently, adaptably, and effectively. Innovativeness refers to the likelihood of being a leader through the use of technology. Discomfort is the perceived inability to regulate the use of technology and lastly, insecurity is referred to the lack of trust over technology, which stems from scepticism and concern over the potential of having harmful consequences.

For this study, optimism and innovativeness helped address research question one and two by establishing the librarians' attitudes toward technology and assessing the elements that

influence technology acceptance. The components discomfort and insecurity was used to identify factors that inhibited librarians from accepting technology in line with research question three. Furthermore, the constructs shed new light on some of the challenge's librarians faced regarding the application of technologies within the library. The study used the TRI to underpin the important questions of the study. As the researcher aimed to investigate the preparedness of the public library for the 4IR technologies, the TRI was suitable for this study as it consists of the four factors that will be used to evaluate librarians' view on technology. Moreover, the index has been used in various fields like the cellular technology, cloud computing, also health care modern self-service methods and some commercial transactions (Chen *et al.*, 2013; Hallikainen & Laukkanen, 2016).

1.7 SCOPE AND LIMITATIONS OF THE STUDY

When conducting a research study, it is essential that the study shows what it covers, as boundaries are important in a study to provide direction. The study examined library technology preparedness in anticipation of the 4IR. The study focused only on the NLSA, Pretoria. The subject of analysis was the staff of the National Library, which included only the library management staff and librarians, knowledgeable in technology acquisition, use and inventory of the National Library. The exclusion of other forms of libraries, such as academic library, school library and corporate library and or users of the NLSA, Pretoria, was due to time and financial constraints as well as the nature of the dissertation. If the scope was wider, it would have been costly, especially in terms of time (semesters), and the researcher could not extend the study to other libraries due to the pandemic (COVID-19). The researcher found it difficult to navigate through such hard times.

1.8 SIGNIFICANCE OF THE STUDY

The study's findings will benefit to the LIS sector at large, professional and academic. The study will furnish a better understanding of how the National Library will be shaped by the 4IR and the implications into the future. Professionally, it is expected that the study will advance library management and staff's knowledge and understanding of the dynamics associated with the 4IR readiness and implementation in the National Library. Ahmat and Hanipah (2018) state that introducing 4IR in libraries would contribute to revising new business models, restructure the business process flow, remaking the job description and job roles. The researcher hoped to

impact management policies, and practices to enable preparations for better services for the society. Academically, the study will also add to the existing knowledge about 4IR. Should the library prepare and thereafter implement the 4IR technologies, it would impact how academics and diverse library users, use and access the improved library services. Library services could be available anytime and anywhere, making information access exciting. Additionally, researchers in the field may ascertain how far the National Library has prepared to embrace the new revolution and thus produce future studies.

1.9 RESEARCH DESIGN AND METHODOLOGY

A research design is a method of for determining how a person plans to carry out a study (Babbie, 2011). The study applied the pragmatism paradigm, which uses a mixed method strategy, both the qualitative and quantitative research methods, and draws numerical and narrative approaches. The study was conducted at the NLSA, Pretoria, which involved the librarians and library management staff. The researcher employed the purposive sampling technique because the researcher wanted to conduct the study specifically with the library management and librarians. Data were collected using a questionnaire and a semi-structured interview schedule. The study employed the SPSS (Statistical Package for Social Science) software to analyse the data collected from the questionnaire. The data that was gathered from the semi-structured interview were coded, cleaned and analysed using the manual content analysis to help identify and summarise content information. The research was conducted in accordance with the University of KwaZulu-Natal's research ethics policy, where ethical clearance was granted to conduct the research and COVID-19 protocols followed.

1.10 DEFINITION OF KEY TERMS AND CONCEPTS

The importance of defining terms ensures that reader is clarified on key terms or concepts used in a dissertation. This results in a clear understanding of the study. Below are the definitions of some of the study's important terms:

1.10.1 FOURTH INDUSTRIAL REVOLUTION (4IR)

The 4IR stands for the newest, popular technologies that are changing the digital revolution that have begun 20th century second half (Corfe, 2018). The 4IR comprises of the internet connected household appliances, the IoT, automatic cars, big data, robotics, Artificial

Intelligence, block-chain, nanomaterial, cloud-computing, neuro-technology, and drone delivery (Tella, 2020).

1.10.2 ARTIFICIAL INTELLIGENCE (AI)

AI is defined as a field of study that focuses on how machines can mimic human learning and have the capability to respond to certain commands (Alsendreh, 2017).

1.10.3 INTERNET OF THINGS (IoT)

IoT is a group of components that comprises of internet-connected smart devices that can utilize embedded devices, such as hardware for communications, sensors, and processors to not only collect, but also sending and tracking actions on environmental data (Gills, 2022).

1.10.4 ROBOTICS

Robotics/robots are mechanical tools that automate tasks commands that are from a direct pre-determined program of human oversight, or the use of artificial intelligence to create broad standards (Talaviya *et al.*, 2020).

1.10.5 BIG DATA

Big Data is defined as an emerging field that presents IT challenges in regards to the data's capture, storage, structure, and visualisation (Garoufallou & Gaitanou, 2021)

1.11 SUMMARY

The chapter provided the study's introduction and the overview of the problem statement. It included a summary of the study's goals, objectives, and research questions. The conceptual framework that grounded the research project was outlined in the chapter, including the study's scope, limitation and significance. The methodology adopted was elaborated, and the definitions of the key terms appropriate to the study were provided.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

The chapter offers the study's review of the literature. The chapter summarises previous findings on libraries and their preparedness for the use of 4IR technologies. The analysis of previous studies was undertaken so that the current study could effectively answer the research questions and fulfil its objective. According to Creswell (2014), a literature review will help a researcher determine if the study topic is worthy to be studied, and if it provides information about how a researcher can limit the inquiry's scope to a necessary area. Walliman (2018) explains that the literature review is part of a research proposal, a thesis or dissertation and is a crucial beginning of the study project and supports the justification about why the project is worthy of being conducted. The current study sought to determine public libraries' preparedness for the 4IR using the NLSA as a case study.

Chapter two is organised as follows: the section reviewed studies on the history of the 4IRs, followed by the applications of the 4IR and its technological applications in libraries, such as AI, IoT, robotics and big data. The subsections deal with an evaluation of library preparedness for the revolution, perceptions of librarians towards the process and challenges libraries face with the emergence of the new revolution. Furthermore, the current study adapted the TRI to enable an effective analysis of preparedness of the NLSA for the 4IR. The TRI measures people's ability to adopting and utilize cutting-edge technologies through the constructs of optimism, innovativeness, discomfort and insecurity (Parasuraman & Colby, 2015; Parasuraman, 2000, p. 308). The chapter is concluded with a summary of the literature review.

2.2 REVIEWING STUDIES ON THE HISTORY OF THE 4IR

The world stands on the edge of a technological revolution that will fundamentally change how people live, work, and relate to each other (Schwab, 2016). Over centuries, technology evolution has drastically changed continents and economies. The earlier industrial revolutions have had their share of positive impacts on numerous stakeholders. For instance, nations became richer, as technologies have helped pull entire societies out of poverty and hard labour (Schwab, 2016). The 4IR stems from the first industrial revolution, where inventors and scientists evolved the working environment through technology to enable easier and faster job execution. This resulted in the technologies currently taking the world by storm, and libraries

have been also affected. The next section reviews studies on revolutions and their impact on libraries.

2.2.1 THE FIRST INDUSTRIAL REVOLUTION

The first industrial revolution emerged in the United Kingdom in the eighteenth century, where steam and water were harnessed to create new machines (Ferenandez, 2020). The revolution included the invention of the steam engine to manufacture products faster and more effectively. This marked a swift innovation in the era of agriculture and manufacturing, like economy transformation, created a market for invention, profit and formed a true labouring class of labourers (Lund, 2021). The first industrial revolution needed the use of either people or domesticated animals to carry out planting and harvesting tasks, where animals were used for pullers for ploughing for farming (Stearns, 2013). The first revolution thereafter involved a move from rural-agriculture production to urbanised machine production through a creation of core infrastructure such as vapour, steam powered machinery and fuel that required less human guidance and effort (Stearns, 2013). One of the greatest impacts of this revolution was the capability to use mechanical energy without human involvement.

Tella (2020) explains that in the first industrial revolution, libraries' administration was weak, acquisition funds were inadequate and library services were almost non-existent. However, Pinch (2021) explains that in the 18th century, libraries become more public and provided lending possibilities of library materials more frequently. History reveals that the first national library was therefore founded during 1753 as part of the British Museum, and many other national libraries followed in the 1800s (Zella, 2021). The bibliographical organisational tools had improved during the Enlightenment period, thus making it easier to structure the libraries and keep track of book collection (Zella, 2021). The very first catalogue cards were introduced in France in the 1700s, marking the first organisation of books in the stands with their spines facing outwards (Zella, 2021).

2.2.2 THE SECOND INDUSTRIAL REVOLUTION

Towards the end of the 18th century and the first decade of the 20th century saw the second industrial revolution. It resulted in significant advancement in communication, both cable and wireless, and electrical delivery, ammonia synthesis and innovation power generation techniques (Davis, 2016). Lund (2021) states that the 'Technological Revolution' was encountered in the late Victorian era to the 20th century, it dealt with using the strength of the

engine and electricity. During this time, people experienced the development of different telegraph networks, light bulbs, vehicles and aircrafts (Lund, 2021). West (2021) explains that the second revolution brought about change in standardisation, technical complexity and precision in manufacturing, technical infrastructure such as electricity and new forms of transportation.

Mokyer and Strotz (1998) surveyed some of the imported technological developments during the 1870-1914 period and explains in detail the path-breaking inventions of the second revolution. In 1850, the age of iron became fully established and steel was of great significance. The second development was chemicals, from which German chemists such as Friedrich Wohler, Robert Busen, Leopold Gmelin, August Van Hofman and Friedrich Kekule von Stradoniz created modern organic chemistry. Thirdly, the electricity which was applied to solve economic problems represented the electronic age, which came with technological systems, the invention of telegraphs, submarine cables, electric railways, electric blankets, hotplates and light bulbs. Fourthly, in terms of transportation, railways became faster, safer and more comfortable through the invention of the diesel engine and the invention of a turbine transformed transportation on sea.

The 18th and 19th century was the age of great national libraries due to the increasing popularity growth of scholarships within the field of philosophy and history (Zella, 2021). Library management in the late 18th and 19th century improved due to the size and growth of institutions. Different types of libraries were founded to store the necessary resources to eliminate the space and systemisation problems (Zella, 2021). Aside from the national libraries, school libraries and specialised libraries were reinvented.

2.2.3 THE THIRD INDUSTRIAL REVOLUTION

In the late 1900s, the industrialism's third wave, sometimes known as the digital revolution started and was characterised by the speed of automation and digitisation through the use of electronics and computers, the innovation of the internet and the discovery of nuclear energy (Ward, 2019). This advancement in telecommunication led to the spread of globalisation, which turned firms to relocate their production to low-cost nations overseas and radicalised business models worldwide (Ward, 2019). The 3rd industrial revolution opened the door to missions in space, research, and biotechnology through new technology (Institute of Entrepreneurship Development, 2019). According to Roberts (2015), the first catalyst of the

third industrial revolution was established in 1969 along with the development of the Advanced Research Projects Agency Network (ARPANET), which were an early packet switching network and the first network to implement the protocol suits the TCP/IP. Another key trait to the third industrial revolution was a move to nanotechnology, latest materials, intelligence systems, robotics and 3D printing (Roberts, 2015).

According to Coa *et al.* (2018), the third industrial revolution brought the changes in the traditional library systems with the Integrated Library Management Systems (ILMS), which resulted in library automation. The ILMS provided a one-stop shop for ordering library materials and making them available on shelves (Gul & Bano, 2019). Library automation was the first of its kind which revolutionised library working systems from self-changing, discharging, circulation support by barcode, RFID technology and OPAC, which most libraries are familiar with (Gul & Bano, 2019). During the mid-1900, the majority of automated circulation control system were created specifically for a single library (Saurabh, 2018). Sauranh (2018) adds that by the mid-1970s, library automation experts began to focus more on the developments of online, instantaneous circulation control systems, which process circulation purchases as they occur.

In the 21st century, libraries actively embraced various technology from using cable and or wireless connectivity to digital communications from networks within the library (Gisolfi, 2019). Libraries automated the self-check-in and check-out circulations desk, digital catalogue systems (OPAC), internet, automated materials and systems. The evolution of technology has had major transformation in revolutions, impacting various sectors, libraries included. Today, technology has continued to develop and hence, people encounter the 4IR.

2.2.4 THE FOURTH INDUSTRIAL REVOLUTION (4IR)

The 4IR is a concept which was introduced by Klaus Schwab, with the referral that it probably would be extending on “the Third, the digital revolution”. It can be “characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres” (Ocholla, 2020). Schwab (2017) explains that we are witnessing a profound shift across various industries, which are marked by the introduction of new business modules, incumbents’ disruption, and the reshaping of structural production, computing, transportation as well as delivery systems. Also, the author further contends that the extreme ambiguity around the developments and adaptation of emerging technologies denotes that we are unaware of how

the transformation of the industrial revolution as a driving force will occur. Their degree of complexity and connectivity across many sectors will imply that participants in the global society, which include: government, businesses, academia's, and societal stance, have the responsibility for collaboration to be knowledgeable about the cutting-edge technologies (Schwab, 2017). The 4IR refers to the new emerging technologies that have extended from the digital revolution that had begun in the mid-20th century (Corfe, 2018). The 4IR includes internet connectable household appliances, IoT, self-driving vehicles, big data, AI, block-chain, robotics, cloud-computing, neuro-technology, nanomaterials and drone delivery (Tella, 2020).

The prospects and realities of the 4IR have proven to be shaping policies across various spheres of national life already, including the national governments, academia, civil societies and private sectors (Marivate *et al.*, 2021). Authors around the world have explored the context of 4IR in governments. Bayode, Poll and Ramphal (2019) explored the 4IR regarding South Africa and noted that in responding to the phenomenon, nations throughout the globe, particularly, developing industrial economies such as our own, South Africa, intends to capitalise on the leapfrog developments. The government of South Africa recognises that the 4IR offers the possibility to advance industrial developments and could also make people's lives better (Bayode, Poll & Ramphal, 2019). In the bid to support organisations to identify future developments in the 4IR, countries like Germany, the United States, China, and Japan have introduced objectives to modernise their industrial production sector (Bayode, Poll & Ramphal, 2019). The US government aims to have programmes to facilitate innovation, acquiring people, enhancing the business climate, and speeding up global competitiveness (PCAST, 2014). In China, the 4IR initiative involves transforming technology industrial focus on several biotechnology and automotive industry to be more aggressive and upping local production of essential components (Lee, 2015). Schwab (2018) explains that Japanese businesses started the value chain effort to provide software and communications for industrial 4.0 standards to conduct a smooth link for businesses on the internet-based tools that encourage cooperation among economies.

The 4IR era has been visible and greatly affected all nations around the world and industries, libraries included. Today, many libraries have gradually embraced trending technologies of industry 4.0, which includes adoption of robotic technology for service delivery. Libraries in the Southern Africa have successfully accepted the use of AI and have purchased robots to help

library staff; for example, the library at the University of Pretoria in South Africa and the library at the University of Lagos in Nigeria, (Echedom & Okuonghae, 2021). Lund (2021) states that the 4IR libraries are already familiar with the emerging technologies, AI already exists in library systems. The existence or presence of robotic cranes, iBeacon, robots, intelligent systems and Radio Frequency Identification (RFID) technology in libraries indicates that libraries have taken the initiative to implement the technologies of the 4IR era (Hoy, 2015; Nie, 2016 & Wojcik, 2016). A detailed review of 4IR tools, their categorisation and applications are presented next.

2.3. FOURTH INDUSTRIAL REVOLUTION (4IR) APPLICATIONS

The 4IR applications/technologies include AI, Big Data analysis, block chain, self-driving cars, IoT, robotics, and smart manufacturing systems, which have mainstreamed to enable faster digital transformation and have solution-oriented service delivery (New Delhi, 2021; Tella, 2020). These technologies have offered exceptional applications in the development/evolution of technology (New Delhi, 2021). The 4IR introduces a number of new technologies relevant to librarians and information professionals to use in libraries. Due to the nature of the dissertation, the researcher discusses only four innovations, which are currently visible in libraries, AI, IoT, robotics and Big Data. These applications are said to have the potential to not only boost, both cost reduction and quality improvement of library services and goods (Chigwada & Chisita, 2021), and are therefore explored in the subsequent sections.

2.3.1 ARTIFICIAL INTELLIGENCE (AI)

AI refers to a computers capacity to carry out complicated task that are pertaining to human intellect (Kayembe & Nel, 2019). Alsendreh (2017) regard AI as a study that focuses on how robots can learn much like humans and have the ability to respond to certain behaviours. For Hayani *et al.* (2021), AI is described as demonstrated intelligence by an artificial entity. It is a branch of science that deals with using machines to solve complex problems more humanly. This is usually done by imitating human intelligence's characteristics and thinking analogies and applying them as algorithms known as computers (Hayani *et al.*, 2021). AI has the ability to also learn and have problem solving skills by using statistical data, making it an appropriate system for managing and controlling equipment's that generate vas amount of different data in real time (Bayode & Ramphal, 2019). There are several examples that people use on a daily bases; for example, Face-ID on iPhone, text editors, Chabot's and digital assistants. Bello

(2021) explains that Face-ID on iPhone helps unlock phones through face identification or recognition, text editors provide best writing experience, where an AI algorithm is used to identify incorrect grammar usage and suggest corrections. Chabot's and digital assistants are used to impersonate customers' conversational styles using natural language processing, currently used by many businesses to assist potential customers with online queries (Bello, 2021).

In libraries, AI is one of the newest developments in computers (Omame & Nmecha, 2020); the current technology has changed incredibly overtime and has huge prospects and promising application for libraries. AI applications in libraries can reduce human errors and have the ability to work 24 hours without getting tired; thus, allowing librarians continue with other responsibilities. Because they can work effectively at scales and speed that are greater than those of humans, AI will maximise speed, work efficiency and effectiveness in processing library material and increase library service delivery (Omame & Nmecha, 2020). According to Sridevi and Shanmugam (2017), AI is the modern technology that is used to manage digital libraries, and examples include Natural Language Processing (NLP), Expert Systems (ES), Pattern Recognition (PR) and Robotics. Natural Language Processing (NLP) in libraries is applied to help search on online databases such as Online Public Access Catalogue (OPAC), library indexing to enable easy document retrieval, which as a result has reduced the proportion of recalls and file retrieval (Vijayakumar & Sheshadri, 2019). Vijayakumar and Sheshadri (2019) further proffer that ES enable dialogue between staff and patrons, patrons and databases. Expert systems help the librarian to fully understand the need for skills improvement and productivity, reference services, cataloguing, classification, indexing and acquisition (Vijayakumar & Sheshadri, 2019). Robotics in digital libraries can provide the capability to search collections of over millions of materials, provide instruction, education, assist with the organisation of library materials and shelf-reading, maximising the efficiency and effectiveness of library operation (Sridevi & Shanmugam, 2017).

Romero (2018) studied four ways in which libraries can get better with the use AI and Big Data. The study reports that suggestion from AI systems can be based on user history or past purchase interest, which is a thought-out way to enhance the purchase of library material also improve user experience through recommending magazines, journals and writers. The massive automated storage and retrieval system purchased by the University of Technology in Sydney, is said to be one of the greatest examples of AI in libraries. Omame and Nmecha (2020) aver that

the AI system in the University of Technology is designed as a robotic crane underneath the library and tends to thousands of closely packed stacks of books. It is further explained that the robotic crane stores and retrieves materials for patrons upon request from the online catalogues of stored library books. When there is a particular request, the robotic crane automatically searches for the requested item/s and once retrieved, the item is delivered to the library's hold shelf for users to pick up (Omane & Nmeha, 2020). The AI systems advantage include the increase of library material retrieval, minimisation of storage space and minimisation of cost (Omane & Nmeha, 2020).

2.3.2 INTERNET OF THINGS (IoT)

The IoT provides interconnectivity of computing devices (mechanical and digital machines) and offer the capability of data transportation through a network interaction between humans or computers or both (Rouse, 2019). Ossiran *et al.* (2017) add that IoT refers to the connectivity of billions of networks-enabled devices with diverse requirements. Undoubtedly, IoT will affect all sectors of the economy such as automotive, construction, energy and manufacturing. Olaitan *et al.* (2019) state that the IoT enables the integration of automation, machine-to-machine connectivity, and big data technologies that has been unsterilized in industrial establishments for many years. IoT is an ecosystem that has a web-enabled smart device that utilise embedded devices such as CPUs, sensors, and communication hardware, to retrieve, transfer and act on the data that has been acquired from the environment (Gills, 2022). The IoT enables people to live and work more wisely and gain control over their lives. Bayode *et al.* (2019) explain that these connected devices or gadgets can retrieve and exchange a large amount of real-time data. For example, the 'smart fridge' is able to detect when the milk has almost run out and adds it to the shopping list (Hoy, 2015). The interconnections of tangible objects such as machinery, automobiles, buildings, and other things that include electronic software, sensors, actuators and network connectivity makes it possible for objects to collect and exchange data (Hoy, 2015). The IoT is also a recent innovation in libraries.

Kassab *et al.* (2019) state that with nearly 20.4 billion internet-connected devices to the internet, the IoT is already used in many different industries. Libraries are ideally situated to benefit from IoT, as IoT can be combined into physical systems of the library (Hoy, 2015). In order to help their clients, comprehend and use these new technologies in their lives, librarians can serve as local specialists. The IoT can be used to improve library services, by collecting information and user services, offer exciting library experience for patrons (Mohammadi,

2018). In their libraries, librarians are already familiar with this, through the use of RFID, which provides a similar function by engaging with machines, tags and updates library management systems with book entries issued to users (Pujar & Stayanarayana, 2015; Vardaraju, 2018). Nie (2016) reports that RFID technology has been applied to domestic public libraries and universities, its practice has greatly improved the working efficiency, service level and library automation management level.

However, the IoT is still in its developing stages, but already has a huge potential for libraries (Pujar & Stayanarayana, 2015). Hoy (2015) also states that IoT is still just an idea in libraries and explains that IoT Beacon device could interest libraries. It is reported that the Beacon device is a combination of smart-phone applications and transmitter beacon, which provides location-specific information and updates customised information into individual users. Libraries can also use these-9 to provide event announcement, locations and item recommendation (Hoy, 2015). Wojcik (2016) explored the potential of IoT technology in libraries, and discovered that the public library in Orlando is the first library to implement the BluuBeam application, which is based on iBeacon technology. The BluuBean provides location-based data to mobile devices, which then enables users search for resources and expand their interest with contextual cues (Sarmah, 2015). The BluuBean application used in the public library in Orlando is also used by almost 30 other libraries in the USA (Wojcik, 2016). Patil and Patil (2018) maintain that the future of IoT applications in libraries seems robust, looking into the developments in the LIS worldwide. Once the IoT is fully evolved, it may change how libraries operate and provide services to their users (Patil & Patil, 2018). Libraries may be turned into smart buildings, service intelligence and communication intelligence where patrons can interact with various items in the library and get virtually different kinds of information using devices with communication capabilities (Patil & Patil, 2018).

2.3.3 ROBOTICS

According to Tella (2020), mechanical engineering, computer science and other disciplines are all included in the interdisciplinary field of robotics. It is further explained that robotics is a branch of engineering that involves the concept of design, manufacturing and operation of robots. Robots are mechanical devices that automate tasks that are led by direct human supervision or a pre-defined programme and set of general guidelines through the use of AI technologies (Talaviya *et al.*, 2020). Abraham (2019) also states that robotics is a form of

machine that can be utilized to carry out automated instructions that are being programmed by a computer. According to Hanna (2021), the mandate of the robotic field is to create intelligent machines that can help humans in different ways. Today, industrial robots, and other types of robots can be used to perform repetitive tasks; these may take the forms of a robotic arm, robotic exoskeleton or the traditional humanoid robots (Hanna, 2021). Furthermore, for robots to operate, they need the combination of computer programming and algorithm, a remote-controlled programme, actuators and control systems. Oztelmeel and Gursel (2018) add that technology has provided surprising products and systems, like drone cars, smart television, and the interconnection of thousands of electronic devices implemented in human-bodies resulting the humanoid robots. As a result, robots can now play games, walk and attend to complex tasks. New innovations of technologies have enabled robots to control their own environment (Oztelmeel & Gursel, 2018). For example, Du *et al.* (2017) developed a prototype robotic cloud using a popular Google application engine to signify its design methods, fostering a digital transformation and Bartacchini *et al.* (2017) similarly designed a robot with social-like interaction that carry out actions with customers.

Robotic technologies are like other rowdy technologies like IoT, augment reality, 3D printing and big data that have found their way into libraries (Owolabi *et al.*, 2022). These technologies have transformed library and information services, associational bodies such as International Federation and Library Associations and institution (IFLA), the American Library Association (ALA), and South African Library Association acknowledge the existence of robotics technologies in libraries (Owolabi *et al.*, 2022). In most libraries, especially academic ones, there is a diversity of autonomous shelf-reading robots, tele-presence, Chabot's and human robots which assists with reference services and the maintenance of circulation materials (Tella, 2020). An example of robotics in academic institutions includes the University of Pretoria, which implemented the robot called 'Libby', the first humanoid librarian in Africa (Ocholla & Ocholla, 2020). This shows that the existence of robotics is visible in academic libraries, thus allowing librarians to focus on other important library responsibilities and deliver information services that are satisfactory to the user (Owolabi *et al.*, 2022).

The automatic robotic shelf scanning (AuRoss) system advance on behalf of Singapore's National Library Board, which navigates and scans library shelves to monitor books location, is another example (Blackemore, 2016). Liau (2019) indicates that in public libraries' in Singapore, robotics and autonomous sorting machines are used to assists staff and offer help

with sorting of books that are returned, shelf read library material and transfer library materials. Harada (2019) reports on robotics and AI technology in Japanese libraries, where the YAMANAKA Public Library has implemented the humanoid robot called 'Pepper'. The robot Pepper has been employed in the YAMANAKA Public Library since 2015, but not only in the YAMANAKA Public Library (Harada, 2019). The Fukuoka City Public Library has also used 'Pepper' from 2016-2018 and the Kitami Institute of Technology Library since 2017 (Harada, 2019). It is further reported that a number of 'Peppers' have been introduced to Xamato City Library. The company TRC Library Service Inc. 'Pepper' has been introduced to more than 500 local government in Japan and 5 libraries in Tokyo (Harada, 2019). 'Pepper' in libraries is mainly employed for helping with displaying library guidance and provide information for tourist on the tablet that is on its chest (Harada, 2019). Lastly Asemi *et al.* (2020) reviewed intelligent systems in libraries with special issue on expert systems, AI and robotics. It is reported that librarian robots exist in libraries and are mostly designed for detecting and replacing books on shelves, reducing many common and duplicate activities (Asemi *et al.*, 2020).

2.3.4 BIG DATA

Big Data is a set of large complex data, that is structured and unstructured, with traditional processing techniques and or algorithms (Sakyi, 2016). It aims to reveal hidden patterns which has led to an advancement from a model-driven science paradigm into a specific science paradigm (Sakyi, 2016). Kayambe and Nel (2019) state that Big Data is understood as a high-volume, velocity, and high-variety information asset that demands cost-effective and innovative information processing forms that enables enhanced insight, decision-making and process automation. Tella (2020) elaborates that Big Data is a field of study that teaches ways to systematically remove information from or else deal with sets of data that are large or complex to be dealt with using traditional data processing. According to Garoufallou and Gaitanou (2021), Big Data is also known as a field that presents information technology challenges with regards the data's capture, storage, structure, and visualisation. Dumbill (2013) explains that Big Data is data that surpass the processing capacity of a conventional database systems; the data are either too big, move fast, or do not fit within the structures of database architectures. Big Data is a mixture of the following four important characteristics: volume, velocity, variety and veracity (Slonime *et al.*, 2012). Schroeck *et al.* (2012) explain that volume refers to an amount of data; velocity refers to data that is in motion and particularly

referring to the speed at which data are created, processed and analysed. Variety is explained as managing the complexity and heterogeneity of many datasets and veracity refers to data uncertainty and the level of reliability/quality of data.

Another new technology relevant to libraries is Big Data. In relation to LIS professionals, this is a very powerful tool as the availability of Big Data drives the necessity to train librarians to be capable of capturing and analysing data to enhance information services (Tella, 2020). Garoufallou and Garfanou (2021) state that within the context of Big Data, the long-established library services concept has changed, as essential library collection development needs an effective analysis of the needs of library users. Through the implementation of Big Data technologies, new insights can be acquired and new services may add to existing ones (Garoufallou & Garfanou, 2021). As many other organisations are grabbing the opportunity that comes with Big Data improving their services and operations, and so are libraries of all types (Tella & Kadri, 2021). Big Data analytics can help librarians assess and improve library services to provide a higher quality, targeted services characterised by a self-adaptive personalised information system and knowledge services (Garoufallou & Garfanou, 2021). Li *et al.* (2019) add that the demand of Big Data is growing in digital libraries. In digital libraries, Big Data comprises the use of electronic and document resources, information data use, such as lending information and perusing history (Wang, 2015). Tella and Kadri (2021) explain that Big Data is also relevant to academic libraries; they range from electronic catalogue, digital contents from different forms, highly structured Meta catalogue data and quantities of unstructured data.

2.4 LIBRARIES' PREPAREDNESS FOR 4IR

The disruptive technologies that are brought forth by the 4IR require libraries and librarians to reconsider how they conduct their business to meet diverse users effectively. The 4IR era has greatly affected the way librarians and information centres conduct their daily activities. The new revolution is calling for librarians who have an in-depth knowledge of particular fields with significant knowledge to use the range of these technologies in various areas (Chigwada & Chisita, 2021). Tella (2020) contends that libraries need to be hostile and review their library resources and services to be relevant and functional in the 4IR era. Consequently, the current study incorporated some of the themes earlier mentioned to underpin the research. Ahamat and Hanipah (2018) point out a number of strategic actions that libraries need to consider in preparing for the disruptive changes of the 4IR era. These include reshaping organisational

behaviour, redesigning new organizational models; restructure organizational process and remake job descriptions and roles. Nwaohiri and Nwosu (2021) also mention that to prepare for the 4IR era, library managers and librarians should modernize their skills and resources such as: Open Educational Resources (OER), Institutional Repository (IR), Library Management Software (LMS), Websites, Social Media, Databases and systems. As a result, the 4IR skills of librarians were evaluated for preparedness in the present study. These involve all types of public, national, academic and school libraries and all these libraries should follow these adjustments with patience (Chigwada & Chista, 2021). Unfortunately, 4IR does not often occur in literature (Ocholla & Oholla, 2020), especially in public and national libraries. Thus, other libraries are reviewed in order to determine 4IR preparedness in libraries. Accordingly, the current study aimed to add the context of the NLSA and 4IR research to the literature. The addition to the literature is expected to help public libraries and others adopt a 4IR preparedness framework.

Owolabi *et al.* (2022) investigated the readiness of academic librarians to use robotic technologies in the Nigerian university libraries. Owolabi *et al.* (2022) stated that university libraries' readiness to adopt robotic technologies is nothing to report about. The study revealed that 60% of the respondents indicated the lack of digital infrastructure for the adoption of Ai technologies. 27% of the respondents stated a lack of policy framework to help encourage the use of robotic technology in the academic library. This indicated a lack of proper infrastructure and management policies to implement 4IR technologies in the libraries. Tella (2020) contends that many libraries in Africa lack the necessary resources and regulations to encourage use and access of 4IR technologies despite available resources. Therefore, this slows the process of adoption and preparation for innovative trends continuously developing within technology. In short, the current study explored the promotions, awareness and potential availability of the 4IR infrastructure.

Ocholla and Ocholla (2020) analysed the 4IR readiness of academic libraries in South Africa to support for research in education and learning, using content analysis from websites of 26 universities and databases. The findings indicated that South African university libraries through their offering are effectively responding to the transformation, innovation and creativity (Ocholla & Ocholla, 2020). The findings also indicated that the presence of emerging trends is visible at 64%, robotics 4%, ICT devices 19%, e-catalogue and e-resources 92%. Shonhe (2018) assessed the readiness of public librarians in Botswana to use technology, using

the Technology Readiness Index (TRI). The study revealed that public librarians are prepared to adopt information communication technology, according to the survey. It was discovered that there was 100% use of social media networks, 95% internet/WIFI connection, 73% technology hubs, although there was no indication of electronic inter-library loan usage, 9% participants indicated low level usage of cellular technology, library administration systems and OPAC. Clearly, ICT in Botswana libraries is available at a minimum level (Shonhe, 2018). Thus, this will make it difficult to transition into the 4IR era. The feasibility and deployment of 4IR in large applications are limited globally and particularly in Africa, but it is important to investigate 4IR preparedness through the lens of the NLSA. It was believed that the outcomes will benefit the future agenda of public libraries and others for 4IR.

2.5 PERCEPTIONS OF LIBRARIANS TOWARDS THE 4IR

There is a consensus in the literature that the attitudes and perceptions of librarians significantly affect the implementation of technology in libraries (Ramzan, Asif & Ahmad, 2021). It is further stated that in most cases, failures in innovative technology projects are attributed to the human related problems; hence, the roles of librarians are crucial to the success or failure of technology applications in libraries (Ramzan, Asif & Ahmad, 2021). To understand the perceptions of librarians towards the implementation and adoption of 4IR technologies, literature has been reviewed. Perhaps, the findings of other authors might have been similar or different from the NLSA; hence, the perceptions of librarians were investigated.

According to a report titled industrial revolution 4.0: implications for libraries and librarians to use 4IR technologies, Hussain (2020) explains that librarians across the globe are frightened that the 4IR will negatively impact their jobs, and unemployment will grow alarmingly quickly. Wood and Evans (2018) explored the perception of AI and its possible effect on the librarianship profession. In the survey, librarians were not overly concerned about occupational attribution or transformative effects of 4IR technologies in their field. 90% of the librarians believed that 4IR applications/transformation would take effect in the next 30 years, and acknowledged that super computers will increase job execution. They did not think 4IR technologies will replace librarians in future. Owolabi *et al.* (2022) investigated the awareness and perceptions of AI in Nigeria's administration of university libraries. Through a survey layout that combines qualitative and quantitative methods, the findings of the study revealed that 32, 8% of respondents recognised that implementing AI in university libraries will result in job losses. 23, 9% of the respondents concur that adopting application of AI in libraries

would increase their usefulness to the academic community. Owolabi *et al.* (2022) shown that many librarians view AI technology as computer programs that attempt to mimic human intelligence, resulting in throwing librarians out of jobs. This indicates that librarians are slightly threatened by AI applications, instead of viewing them as applications designed to make job execution easier. Consequently, the current study used the lens of fear of job loss to explore the perception of librarians towards the 4IR in the NLSA.

Wang (2019) investigated how library staff's views librarian robotics in China; the study aimed to capture library staff's perception of using robots in the library. The study used a pilot study and indicated that job insecurity existed among librarian staff, which was relevant amongst the younger respondents. What the 4IR applications in the next 5 years will bring into libraries can only be imagined. Therefore, librarians must acquire relevant skills to fit perfectly within the era. Tella *et al.* (2022) examined the future of libraries in Nigeria during the 4IR. The authors explored the outlook from six academic librarians in Nigeria's point of view. Their findings revealed that librarians perceive 4IR as an essential era for adopting the new technology application. Respondents indicated that the 4IR era will impact academic libraries and librarians' job in the future. Other respondents indicated that 4IR applications will reduce work routines, enable librarians to achieve many tasks within a limited time-frame and make library operations easier, improve service delivery and give librarians an opportunity to have diverse knowledge and skills. The findings also showed that even though librarians perceive 4IR positively, other respondents fear job loss. It was indicated that there is a possibility that the number of librarians and library staff working in the library might be reduced, through the introduction of robots and AI in library operations.

It is clear that the 4IR has so much to offer to librarians and libraries, despite some librarians who are uncertain of the implications of 4IR applications. Investigating the NLSA was significant in understanding how librarians perceive the 4IR applications, and their preparedness for 4IR technologies.

2.6 CHALLENGES AGAINST THE PREPAREDNESS FOR THE 4IR

In the last decade, libraries have witnessed an extensive change of roles (Serholt *et al.*, 2018). According to Castantino *et al.* (2014), libraries' roles as gatekeepers to information and knowledge have been challenged by digitisation and the need to provide access to information anywhere anytime. As technology develops, libraries are forced to refine themselves and adopt

trending technologies (Serholt *et al.*, 2018). However, in the process of technology adoption and implementation, lack of manpower, inadequate IT infrastructure, lack of ICT skills, lack of innovative leaders, and insufficient budget, are among the challenge's libraries experience in adopting technology (Shastri & Chudasma, 2021; Shahzad & Lqbal, 2020).

Hong and Anh (2021) discussed libraries' developments, trends and opportunities in the context of 4IR in the digital era in Vietnam. The study found that libraries face the challenge of information safety and security as data are assessable everywhere. A modern library requires librarians to have sufficient and eligible quantities, qualifications and skills that are beyond the usual library skills (Hong & Anh, 2021). Inconsistent data structures have influenced data exchange among libraries and some software do not recognise records on focused cataloguing software in processing data on the WorldCat Discovery (Hong & Anh, 2021). This requires libraries to update and follow international standards in storing and preserving data using digital data (Hong & Anh, 2021). Hayani *et al.* (2021) investigated AI in Indonesian libraries as a promotion of IAIN Lhokseumawe library in the 4IR. The investigation revealed that the IAIN Lhokseumawe library faces a number of constrains that hinder the adoption of 4IR technologies. It is reported that there is a lack of knowledge on science and librarian marketing promotion, lack of adequate and sustainable funding, and a lack of desire from the government of Acoh Lhokseumawe IAIN to help fund the library and universities (Hayani *et al.*, 2021). Lack of skilled manpower, poor infrastructure, poor funding and unreliable electricity power are some challenges encountered in the tertiary institution in Cross River State, Nigeria (Ogunjimi *et al.*, 2021).

Similar to Ogunjimi *et al.* (2021), Owolabi *et al.* (2022) also established that 48% of the respondent contended that funding was a really difficult issue in the use of robotics in Nigerian University libraries, 30% stated unstable electricity supply poses a challenge, 22% asserted that they fear losing one's job through robotic adoption and 3% indicated that poor telecommunication is a challenge. Resultantly, the fear of losing one's job is a lens to investigate the obstacles to the readiness of 4IR in the NLSA. Nikko and Okunghae (2021) also state that librarians and policy-makers show aversion and anxiety towards adopting technology. This indicates scepticism and resistance to change in utilising new trending technologies by librarians in Nigerian universities. Moreover, international standards are not well known, many librarians relay on the internet to learn about new technology and best practices (Nikko & Okungae, 2021). The next section presents the conceptual framework.

2.7 THEORETICAL FRAMEWORK

The theoretical framework comprises ideas on choosing the research topic, the issue to be looked at, and the questions to be posed, theories to be applied, the methodology to be used, procedure instruments, analysis of the data and interpretation of the results, conclusions and suggestions to be made (Ravitch & Riggan, 2016). The role of a theoretical framework is to provide the general framework for researchers to express and analyse the goals of the study for its intended audience, acts as a guide for choosing relevant research, engaging with it, and interrogating it with other current research literature and theories (Ravitch & Riggan 2016). The theoretical framework is important as it logically conceptualise an entire research project (Kivunja, 2018).

The current study adapted Parasuraman and Colby's modified Technology Readiness Index (TRI). The TRI represents a gestalt (an organised whole) of cognitive motivators and inhibitors that, taken together, determine a person's propensity for modern technology (Parasuraman, 2000). TRI measures the tendency of people to adopt and use cutting-edge technologies through positive and negative inhibitors. The study used the index to underpin the critical questions of the research. The study aimed to investigate public libraries preparedness for the 4IR technologies; the model gives four factors that might be used to gauge librarians' attitudes towards new technology.

The Technology Readiness Index (TRI) is a 36 scale to measure "technology readiness" that captures people's prevailing attitudes for accepting new technology (Prasuraman, 2000; Blut & Wang, 2020). The TRI was created as a result of a series of qualitative research projects with users from a variety of economic sectors such as financial services, online services, e-commerce and telecommunication (Blut & Wang, 2020). The model consists of constructs of four dimensions and 36 variable items. The four dimensions are optimism, innovativeness, discomfort and insecurity. Parasuraman & Colby (2015, p.3) explain the dimensions as follows:

1. **Optimism** refers to a positive view of technology and belief that it offers people increased control, flexibility and efficiency in people's lives.
2. **Innovativeness** refers to the tendency of being a pioneer through or to the use of technology, a leader or opinion

3. **Discomfort** refers to perception of lack of control over technology and the feeling of being oppressed or overwhelmed by it.
4. **Insecurity** refers to the distrust of technology, stemming from scepticism about its ability to work properly and concerns about its potential harmful consequences.

Figure 2.1 below depicts the TRI model's four dimensions, including the contributors (optimism and innovativeness) and Inhibitors (discomfort and insecurity).

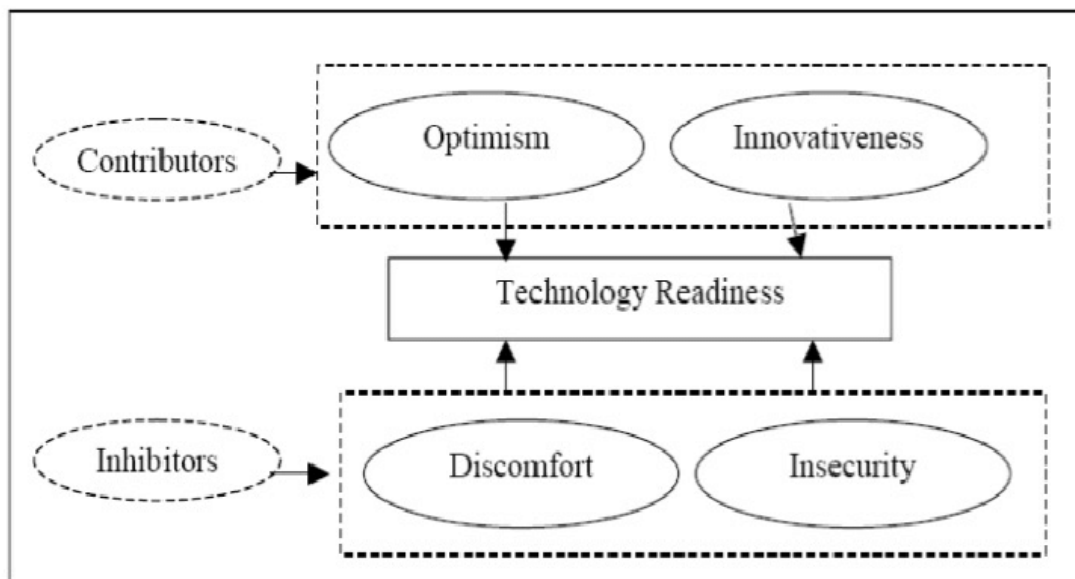


Figure 2.1: Parasuraman 'Technology Readiness Index' model (2000)

2.7.1 APPLICATION OF TECHNOLOGY REDINESS INDEX (TRI)

Parasuraman and Colby (2015) explain that compared to the TRI 1.0, which had used extensively over ten years, the TRI 1.0 had its shortcomings because of its length. The authors explain that TRI 2.0 has a wider application because it is shorter, it results in fewer burdens on surveys measuring many constructs aside just the Technology Readiness (TR), the index has undergone a number of significant improvements that make it more durable for use in a variety of situations over time. Parasuraman (2000) proffers that TRI 2.0 has possesses two broad applications; firstly, it can be applied to evaluate the TR level among a certain population, which consists of teachers, nurses or segments of high-tech items. TRI 2.0 aids in comprehending the mechanics of adopting different technologies by measuring the TR components and overall TR (Parasuraman, 2000). Secondly, TR may play a significant moderating role in research's involved in multiple frameworks, scholars can use the TR index

as a diagnostic or control variable, as well as to describe the dynamics between variables in an environment that is influenced by technology in experiments (Parasuraman, 2000).

2.7.2 APPROPRIATENESS OF TRI 2.0 FOR THE STUDY

The TRI model was appropriate for the study because the study aimed to investigate the preparedness of public libraries for the 4IR. The researcher sought to determine libraries' readiness level for the 4IR. The four elements/construct variables helped address the research questions, which include questions about the preparedness of the library for the 4IR, librarians' perception of 4IR, perceived fears or scepticism to adopting 4IR technologies and challenges against librarians' preparedness for 4IR in the NLSA, Pretoria.

The study noted the appropriateness of the model compared to the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Utilization of Technology (UTAUT). Pires *et al.* (2011) explain that the TAM was essentially created to offer a framework for analysing how external influences affect people's internal attitudes, intentions, and beliefs. The model is built around two key constructs related to beliefs: perceived usefulness and perceived usability. According to Buyle *et al.* (2018), the TAM was initially created to anticipate technology in situations when organizational goals require it. The TAM model has a limitation. Initially, the model concerns the variable which pertains to the behaviour of users, inevitably evaluates through subject means of behavioural intentions such as interpersonal influence (Ajibade, 2018). Thus, making it less applicable as the current study seeks to determine the level of preparedness to use 4IR technologies rather than predict technology adoption through behavioural intentions. Similarly, the UTAUT model, as explained by Nwone and Mutula (2019), is also known to foresee behavioural technology use as a goal, through 8 constructs: performance, expectancy, effort expectancy, attitudes towards technology, social influence, facilitating conditions, self-efficiency and anxiety. In addition, according to Zhang *et al.* (2010), UTAUT is limited to student samples, improper to reflect the real working environment. The model was also not applicable to the current study as the main element of the study was to determine preparedness, which made the TRI model most suitable for the study. Table 1 below maps the research questions to TRI components and the themes addressed.

Table 1: How the TRI components underpin the research questions

Research Questions	TRI Components	Themes addressed
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1. How prepared is the NLSA (NLSA), Pretoria, for the 4IR?	Optimism Innovativeness Discomfort & Insecurity	Measure the overall preparedness of librarians for the 4IR applications based on motivators and inhibitors collectively.
2. How do librarians at the NLSA, Pretoria, perceive the use of 4IR?	Optimism Innovativeness	Establish contributors (motivational factors), the librarians' attitude towards technology and assess the elements that influence technology acceptance
3. What are the perceived fears and skepticism of librarians associated with adopting the 4IR technologies at the NLSA, Pretoria?	Discomfort Insecurity	Establish inhibitor factors that detract librarians from accepting technology.
4. What are the challenges to the preparedness of the NLSA, Pretoria, for the 4IR?	Optimism Innovativeness Discomfort & Insecurity	All four components shed new light on some of the challenge's librarians faced regarding the application of technologies within the library

2.8 SUMMARY OF THE CHAPTER

The main purpose of this chapter was to review existing literature on library preparedness for the 4IR, and related concepts for the current study's aim and research questions. The analysis of available literature showed that librarians fear job loss and context-specific issues regarding their preparedness for the 4IR. The TRI 2.0 model by Parasuraman and Colby (2015) was acknowledged as the most appropriate and suitable model to underpin the study. The components of the TRI model assisted in investigating the level of preparedness for libraries

to use cutting-edge technology. The TRI model seamlessly underpinned the research questions and helped add to existing knowledge. Previous studies and relevant models for the preparedness of 4IR in libraries were reviewed. It was also noted that not much literature was available in the context of public and national libraries, thus other libraries were included in the literature review.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter outlines and discusses various aspects of the research methods of the study. It specifies the study's plan, how the data were collected, the research design, selected population and sample size, and the analysis of the collected data. According to Brynard *et al.* (2014), research methodology describes how to gather data and how to process it within the context of the research process. The planning, organization, and data extraction of a study must adhere to the requirements of veracity, objectivity and validity of methods used (Brynard *et al.*, 2014).

3.2 RESEARCH PARADIGM

The research paradigm represents the researcher's beliefs and values about the world, how they define it, and how they work within the world (Kamal, 2019). For example, positivism depends on the hypothetical deduction techniques to confirm prior hypotheses, which are frequently expressed qualitatively and from which functional links can be deduced between casual and explanatory factors and outcomes (Park *et al.*, 2020). Park *et al.* (2020) further state that, the positivism inquiry generates associational explanations or casual relationships that eventually lead to predictions and control of the phenomenon in question.

On the other hand, there is the post-positivism. The post-positivism theoretical framework is a flexible research approach that allows the researcher to use a variety of methods to conduct research depending on how the study questions are structured (Panhwar *et al.*, 2018). The authors further explain that it through interpretative cooperation, the neo-positivist empirical data produce knowledge view-points.

Moving to the next, interpretivism adopts a relativist ontology, as opposed to measurement-based approach to truth, allows for many interpretations of a same phenomenon (Pham, 2018). For this reason, the research outcomes are undoubtedly influenced by the researcher, interpretation, belief system, and way of thinking or cultural preferences, which may cause too many biases (Pham, 2018). Interpretivism is more interested in complex variables and context-related elements, and think of people as different from physical phenomenon as they develop deeper meanings, they do so under the presumption that humans cannot be studied in the same way as a physical phenomenon (Alharahsheh & Pius, 2020).

Lastly, the pragmatism paradigm combines different approaches that can lead to better research and subsequent management decision, reflecting the social and scientific aspects of the world (Mitchell, 2018). According Hibberts and Johnson (2012), pragmatism is a method of conducting research practice that requires the researcher to use research elements in a manner that will help them with their research difficulty, question and circumstances. In reality, a researcher who adopts this perspective uses a variety of data collection techniques to effectively address the study objectives, focuses on the research's application in real time, and emphasises the significance of conducting a research that most effectively answer the research problem (Creswell, 2013).

A mixed-method research primarily functions within the pragmatist paradigm and is interested in narrative and numerical data. Therefore, the researcher used pragmatism to enable the collection of data using both approaches (qualitative and quantitative) to help the researcher answer the research problem effectively. In the analysis of the research questions, the researcher used both qualitative and quantitative methods. The researcher investigated the perceptions and preparedness for 4IR technology adoption in the NLSA. Pragmatism can be beneficial to research on organisational processes because it sees people's opinions and convictions as instruments for addressing issues and taking new actions, involves research participants as the active participants rather than as descriptors in the present tense that are passive (Kelly & Cordeiro, 2020). Similarly, Shonhe (2019) conducted a study on the evaluation of public librarians' technology preparedness using the pragmatism research paradigm.

3.3 RESEARCH DESIGN

According to Akhtar (2020), the of the proposed research endeavour, or the research design, is what gives a project its structure and what keeps its various components together. The importance of a research design is to articulate a research problem into data for analysis and to provide applicable answers to research questions in a cost-effective way (Asenahabi, 2019). The research design reflects a researcher's idea; it basically helps prevent frustration by binding the research together through a structure that shows all major parts of the research work to try address the research question (Asenahabi, 2019). There are different research designs for conducting research. In the social sciences field, there are four types of research designs, namely; surveys, field studies, experimental designs and case studies.

Survey designs gather data from many respondents of a particular moment to describe the nature of existing conditions (Bertram & Christiansen, 2014). Surveys usually undertake a quantitative or numerical data collection. They also generate quantitative data if there are some open-ended questions from respondents to write down their own opinion on a particular research question (Bertram & Christiansen, 2014). Field studies, instead of asking participants questions, participants arrive at a unique test site configuration to be observed, and the researcher observes the participants in their natural environment (Graney *et al.*, 2020). Experimental designs consist of goal-directed acts on study groups to analyse the effects of these acts (Flick, 2020). An experimental study includes at least two experimental groups, to which participants are randomly allocated (Flick, 2020).

A case study describes a particular situation or event. It focuses on a single case or set of cases (Wildemuth, 2017). A case study has the following characteristics, as explained by Wildemuth (2017): data are gathered via a variety of methods by one or more entities (a person, group or organisation) are analysed; a case study is useful in a study of ‘why’ and ‘how’ questions as these add operational links to be traced over time-frames preferably than frequency or incidence.

A case study is undertaken when a researcher concentrates on a specific case, perhaps because of its exceptional traits, which can aid in comprehension and provide guidance in similar situations (Leedy & Ormrod, 2021). The case studies can be appropriate for examining how a person or programme changes over time. Perhaps due to a certain condition, developments, improvements or event, it frequently serves as a good means of providing preliminary evidence for improbable explanations of the occurrence (Leedy & Ormrod, 2021).

The study adopted the case study because it intended to collect data on the librarians’ preparedness to adopt 4IR technology and learn more about the perception and challenges within the NLSA, Pretoria. As technology has developed over time, the researcher intended to understand how the 4IR would be implemented or adopted in the NLSA. In addition, the research focused on a smaller group; hence, the case study design was effective. Another justification for the case study approach is its inexpensive nature. Tella, Amuda and Ajani (2020) also adopted the case study method when investigating the relevance of block-chain technology and management of libraries and archives in the 4IR era.

3.4 RESEARCH APPROACH

The current study adopted the mixed method research approach. There are three existing research approaches that researchers use for collecting data, namely; qualitative approach, quantitative approach and mixed methods approach (which involves the combination of both qualitative and quantitative approaches).

The qualitative methodology is referred to as research that generates descriptive data, generally, the participants' written or spoken accounts of their experiences are their own or perceptions (Brynard *et al.*, 2014). It enables the researcher to interpret and describe people's actions, and enables a better understanding of complex situations; its work is exploratory and uses observations to create the theory from scratch (Leedy & Ormrod, 2021). Tracy (2020) elaborates that the qualitative method is a concept of an interview umbrella (group or one-on-one), participants' observations (in person or online) and textual analysis (paper or electronic).

According to Flick (2015), the qualitative approach selects participants purposively and integrates small numbers of case studies according to relevance. Data collected are designed much more openly and aim at a comprehensive picture made possible by reconstructing the case under study. Thus, fewer questions and answers are defined in advance; therefore, there is greater use of open questions (Flick, 2015). Flick (2020) states that qualitative research aims much more at creating an environment in which the view of the participants, or the making of social situations can be analysed and understood. Tracy (2020) states that qualitative research is rich and comprehensive and provides more than a picture (provides understanding of sustained process); focuses on live experiences; honours participants' local meaning and explains, illuminates or reinterprets qualitative data and interprets participants' viewpoint and stories.

Tracy (2020) states that quantitative research approach transforms data. This includes conversations, actions, media stories, facial expressions, or any social or physical activity into numbers. The qualitative method employs measurements and statistics to develop mathematical models and predictions. The quantitative method observes the world using instruments (structure questionnaires) that produce quantitative measurement, or numerical data (Tracy, 2020). Remier and Ryzin (2015) report that the qualitative method aims to isolate a single cause at a time and measure its average effect across many individual cases. The results are referred to as an ideographic explanation, meaning an explanation that pays attention to the

distinctive sets of circumstances or conditions that brought about an event or behaviour (Remier and Ryzin, 2015). Creswell (2015) explains that a researcher using the quantitative method chooses what to research and formulates specific inquiries of hypotheses, measures variables to facilitate the finding of answers, using statistical evaluation to explain information needed to address the inquiries /hypotheses and make an interpretation of the results. Walliman (2018) states that the primary purpose of the quantitative analysis is to measure and explore; make comparisons; construct concepts and theories and examine relationships, control and explain a phenomenon.

The current study used the qualitative and quantitative methods to respond to the research questions for the study effectively. Mixing both methods involves collecting, analysing and interpreting both qualitative and quantitative data and integrating findings from two kinds of data into a cohesive whole (Leedy & Ormrod, 2021). Creswell and Clark (2011) state that mixing methods occurs when the qualitative and quantitative are mixed during the stage of the research process when the researcher is analysing two sets of data. First, the researcher quantitatively analyses the data from the qualitative data/strands and qualitatively analyses data from the qualitative strands, and then uses the interactive strategy of merging the two sets of results through a combined analysis (Creswell & Clark, 2011). The study sought to find qualitative and quantitative information from the study's participants concerning their perceptions and level of readiness for the adoption of 4IR within the NLSA, Pretoria.

3.5 TARGET POPULATION

A target population is a set of individuals, items, or data/group of interest that the researcher uses to generalise the research findings (Privitera, 2017). Rahi (2017) defines the target population as a method of selecting a sample of elements from a big population of residents to study their beliefs and attitudes. The researcher's population was the NLSA librarians and library managers who were involved in the day-to-day use of technology to facilitate library service. In this aspect, any librarian and library managers who held a diploma, degree, honours, master's and or PhD qualification in LIS was deemed eligible for participation in the study.

The researcher chose to specifically focus on library management and librarians because the researcher believed that they acquire knowledge of library operations and are involved with the day-to-day use of technology to provide library services to patrons/clients. Furthermore, as

technology develops, the researcher believed that library management and librarians are responsible for implementing and using of trending technology applications.

3.5.1 SAMPLING PROCEDURE

The sampling procedures adopted are non-probability sampling technique and purposive sampling. Sampling procedure involves selecting individuals from a group for which proposition will be advanced at the end. It should be a minimised representation of a population in terms of the elements' heterogeneity and the variables' representativeness (Flick, 2020). Walliman (2018) states that sampling is the process of selecting just a small group of cases out of a large group. Therefore, there are different sampling techniques used in research, which are separated into two types: (stratified sampling, cluster sampling and simple random sampling) and non-probability sampling (quota sampling, convenience sampling and purposive sampling).

Bhardwaj (2019) outlines that probability sampling is a type of sampling, where it is known that there is a probability that each member of the population will have a chance of being selected in the sample. When a population is highly homogenous, each member of the population will be selected in the sample (Bhardwaj, 2019). Etikan and Bala (2017) state that probability sampling is also known as random sampling; it permits every single item from thousands of items or individuals to have an equal chance of presence in the sample.

Stratified sampling selects specific kinds of groups of participants that need to be part of the final sample (Cambell *et al.*, 2020). Iliyasa and Etikan (2021) elaborate that this sampling involves choosing the same group of items from a population based on classification and random selection. Stratified sampling involves separating the target population element into homogenous, mutually exclusive segments from which each segment simply and randomly chosen. Cluster sampling is where the population is divided into clusters or groups, and the sample is taken from these clusters; all the selected members are thus used in the final sample (Taherdoost, 2016). The naturally occurring groups are selected as samples in a cluster sampling, and when the clusters are selected, they are compiled into frames (Sharma, 2017). In simple random sampling, every member of a group has an equal opportunity to be selected. Simple random sampling is popular among researchers who desire to make statistical generalisations to a larger population; such is the case in political polling and census taking (Tracy, 2020).

According to Etikan and Bala (2017), a sampling technique known as non-probability sampling establishes the basis for any estimation of a probability and that fundamentals that are in the universe have a chance to be involved in a study sample. Iliyasu and Etikan, (2021) explain that non-probability sampling uses non-randomised methods to pull the sample unlike sampling with probability, where the technique generally takes in judgment, participants are chosen for a reason. This can be useful for certain studies, such as a quick survey where it is difficult to get access to the whole population (Walliman, 2018).

In quota sampling, researchers specifically describe the control qualities and ascertain how they are distributed in the target population. This means that the sampling is at the convenient access of the researcher, everyone is seen as the same feature and are likely to participate in the study (Sarsted *et al.*, 2017). Once the researcher has established these quotas, the selection of the sample elements is based on convenience judgement, which means that final sample composition is comparable to the target population composition with regards to the pre-determined parameters (Sarsted *et al.*, 2017). In convenience sampling, the researcher chooses the sample because it is convenient, easy and relatively inexpensive to access (Tracy, 2020).

Purposive sampling involves selecting participants that meet the general reasoning of the study; the rationale for the selection needs to be aligned with the study's ontological, epistemology and axiological perspective and aims (Cambell *et al.*, 2020). Purposive sampling moves away from any form of random sampling and is a strategy to make sure that the certain types of cases might be covered as part of the final sample in the research study (Cambell *et al.*, 2020). Kulkarni (2015) explains that purposive sampling involves selecting participants according to pre-determined criteria relevant to the study. Size depends on theoretical saturation (a point when no additional new information is emerging) and most useful when data collection and analysis are done concurrently (Kulkami, 2015).

In this study, the non-probability and probability sampling technique was employed. The sample size and sample technique were separated according to qualitative and quantitative methods. Non-probability sample technique was employed, specifically the purposive sampling technique to collect qualitative data. The qualitative approach selects participants purposively and integrates small numbers of case studies according to relevance (Flick, 2015). The researcher purposively chose the NLSA library managers. Purposive sampling is a strategy used to select participants deliberately to enable the researcher to meet the aims and objectives of the study and to draw important information that cannot be obtained from other participants

or choice. Random sampling was used to collect quantitative data from the NLSA librarians. Random sampling permits every single item in a population to have an equal chance of presence in the sample; it is widely used and most effective in the social sciences (Flick, 2015). Abayomi *et al.* (2021) employed purposive and random sampling to explore the awareness and perception of AI in the management of university libraries in Nigeria. Similarly, Owolabi *et al.* (2022) employed purposive sampling to investigate readiness of academic librarians towards the use of robotic technology in the Nigeria, where the study purposively selected only ten universities in Nigeria.

3.5.2 SAMPLE SIZE

A sample size is the estimate of a population proportion (p), a qualitative variable measured on nominal scale based on point estimate (p) of sample (Kulkarni, 2015). The study's sample size was estimated to be 15 library staff members comprising the library management and librarians. The choice of the 15 participants was based on the published size determination table by Krejcie and Morgan (1970). According to Krejcie and Morgan (1970), if a population (N) of a study is estimated to be 15, the sample (s) size is 14. Table 3.1 below illustrates sample size selection from a given population.

Table 3.1: Krejcie and Morgan (1970) size determination table

<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	100000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

3.6 DATA COLLECTION METHODS

The current study adopted the following data collection methods: semi-structured interviews and questionnaire. Considering that there are various instruments for collecting data in research; in this study, the researcher used a semi-structured interview and questionnaire. Mann (2016) highlights the various instruments for collecting data, including a semi-structured interview, which is a form of a survey that combines open questions that prompt discussions with the opportunity for the interviewer to additionally discover answers. Interviews are conversations with a purpose, and depending on the purpose, interviews can be organised in

different ways, namely; structured and semi-structured (Tracy, 2020). A semi-structured interview was conducted with the library manager of the NLSA.

The researcher used semi-structured interview which was self-administered but also guided by the adapted TRI construct, optimism, innovativeness, discomfort and insecurity. A semi-structured interview allows the possibility of asking new questions. This is dependent on the response to the questions asked, and if there is a need for additional information and or clarity. Tracy (2020) argues that semi-structured interviews have an advantage. They allow for more emic, emergent understanding to blossom, and for the interviewees' complex views to be heard without the constraints of scripted questions. Another instrument used for data collection was the questionnaire, which was distributed among NLSA librarians.

The questionnaire was distributed among NLSA librarians to collect quantitative. The questionnaire was also self-administered and guided by the adapted TRI construct, namely, optimism, innovativeness, discomfort and insecurity. A questionnaire is a tool for generating information, and is often used in research to draw quantitative and qualitative data sources and analysis (Bartram, 2019). Questionnaires are written in different methods and are to be used in different circumstances and with many different data collection mean (Brace, 2018). Kulkarni (2015) reports that a questionnaire is an important tool used alone or as a supplement to an interview. The validity of the information obtained from a questionnaire depends on the quality of the questionnaire. Kulkarni (2015) further explains that the goal of a questionnaire is to collect data that are valid and measures the quantity or concept that is supposed to be measured; it is reliable because it measures the quantity or concept in a consistent or re-procurable manner; and, it is unbiased in that it measures the quantity or concept in a way that does not systematically under or overestimate the true value and discriminating. It can distinguish adequately between respondents from whom the underlying level of quantity or concept is different.

The study used semi-structured interviews and a questionnaire to get answers to the research question from NLSA managers and librarians. Semi-structured interviews were conducted with 2 library managers and 10 librarians at various library sections. Similarly, Mabunda and Plessis (2019) used interviews and a questionnaire to collect data to assess South African libraries in the digital age. The authors further state that they support quasi-statistics as it enables simple counting. The research instruments are attached as Appendices A and B.

3.7 DATA ANALYSIS

As the researcher used both qualitative and quantitative methods, the researcher analysed the statistical data using Microsoft excel. This enabled the researcher to present data in different formats, either as graphs or diagrams. The data collected from interviews were coded; cleaned and analysed using manual content analyses that helped identify and summarise content information.

3.8 VALIDITY AND RELIABILITY

According to Kumar (2011), the ability of an instrument to measure what it is intended to measure determines the study's; it is extent of measurement what the researcher wants to measure. The researcher used both qualitative and quantitative designs, because combining research methods enhances the validity of the study's findings, and the research can be more meaningful and have a greater possibility of being valid. Walliman (2018) states that the combination of qualitative and quantitative methods serves two different purposes: it can help to discover and handle threats against validity arising from the use of qualitative and quantitative research by applying methods from the alternative methodological tradition and can thus ensure good scientific practice by enhancing the validity and research findings.

The researcher also ensured the reliability and validity of the research instruments by pre-testing the research instruments. The researcher pre-tested the research instruments with 10 NLSA staff members who were not part of the main survey. Also, the questionnaire was subjected to Cronbach Alpha analysis, and the interview schedule was subjected to trustworthiness techniques.

3.9 ETHICAL CONSIDERATION

The research was conducted in accordance with the University of KwaZulu-Natal (UKZN)'s research ethics policy. For instance, ethical clearance was granted to conduct the research. Gatekeeper approval was sought and adhered to as per UKZN protocols. The researcher ensured that confidentiality was maintained, that the information the researcher collected from the participants was strictly confidential; and that the researcher upheld anonymity. The researcher did not share any information about the participants with unauthorised people. The researcher was not biased, captured the information from the participants verbatim, and analysed it without any bias. Participants were notified that participation is voluntary and that they were free to cease and withdraw participation in the study at any time without prejudice

by using informed consent. Overall, the study-maintained standards of ethics. The gatekeeper letter, the informed consent form and ethical clearance approval form UKZN are attached as Appendix C, D and E, respectively.

3.10 SUMMARY

This chapter outlined the process followed by the research when conducting the study. It described the research approaches that were used in the research. Pragmatism research paradigm was used while a case study design was adopted. The study used both qualitative and quantitative research approaches to collect data from the library managers and librarians at the NLSA, Pretoria. Non-probability sampling was adopted; specifically, purposive sampling; questionnaires and semi-structured interviews were used as data collection instruments. The reliability and validity of the study was ensured through a pre-test of the instruments, a Cronbach Alpha and trustworthiness criteria.

CHAPTER FOUR: DATA ANALYSIS AND PRESENTATION OF FINDINGS

4.1 INTRODUCTION

As stated in chapter one, the study's main purpose was to investigate public library preparedness for the 4IR through the lens of the NLSA. Furthermore, it investigated the librarians' perception towards the use of 4IR and identified challenges to the preparedness of the NLSA for 4IR. This chapter presents the data collected from the NLSA library staff, librarians and library management. It details how the various participants of the study answered the research questions on the questionnaire and during interviews.

Interviews were conducted with the library management staff, and copies of the questionnaire were distributed among library staff. The research utilised qualitative and quantitative methods to gather, analyse and interpret data. Qualitative data were collected through interviews and quantitative data were collected through a questionnaire. The researcher used the SPSS (Statistical Package for Social Science) software to analyse the data collected from the questionnaire. Data collected from the semi-structured interview were coded, cleaned and analysed using manual content analysis to help identify and summarise content information. Findings derived from copies of the questionnaire were presented in tables and graphs whereas interview data were presented in narrative form. Therefore, this chapter presents the data that were collected logically through the use of illustrations and text (Gissane & Ruswick, 2017). Creswell (2014) describes data analysis as a process in which the researcher reports quantitative data and thereafter discusses the quantitative findings to confirm or disconfirm statistical results. Accordingly, the presentation of the findings is not separated into different sections but integrated into a logical sequence with the findings from both the questionnaires and interviews as appropriate. The research questions/research objectives of the study framed the presentation. The chapter is organised into the following subsections: 4.2 Response rate; 4.3 demographics; 4.4 findings; 4.5 challenges; 4.6 additional interview analysis, and lastly, 4.7 summary.

4.2 RESPONSE RATE

As stated in the previous Chapter three, the estimated population for the study was fifteen ($n=15$), s (sample size) fourteen (14), which involved 4 library management staff and 10 librarians. For this study, all the 10 copies of the librarians' questionnaire were successfully returned and 2 interviews were conducted, making a total of 12 participants giving a response

rate of 85%. It was through data collection that the researcher learned that there would only be three library management staff participants directly relevant to the subject of the study. Although, only two library management staff participated, one was not available to participate. Every researcher’s goal is to attain a response rate of approximately 60% because a low response rate reduces the validity and reliability of a study’s outcome (Adeleke, 2017). For this study, the total response rate was 85%, which was satisfactory and met the needs of the study. Table 4.1 represents the details of the response rate for the study’s qualitative (interview) and quantitative (questionnaire) aspects.

Table 4.1: Response rate summary (N=12)

Population	Expected	Actual	Percentage
Management	4	2	50%
Librarians	10	10	100%
Total	14	12	85%

4.3 DEMOGRAPHIC PROFILE OF RESPONDENTS

According to Pressat (2020), demographic information describes a human population with respect to their demographic structure, sex, age, occupation, education and profession. In this section, the demographic information for the respondents is given.

4.3.1 GENDER OF RESPONDENTS

In this study, both males and females participated, as represented in figure 4.1.

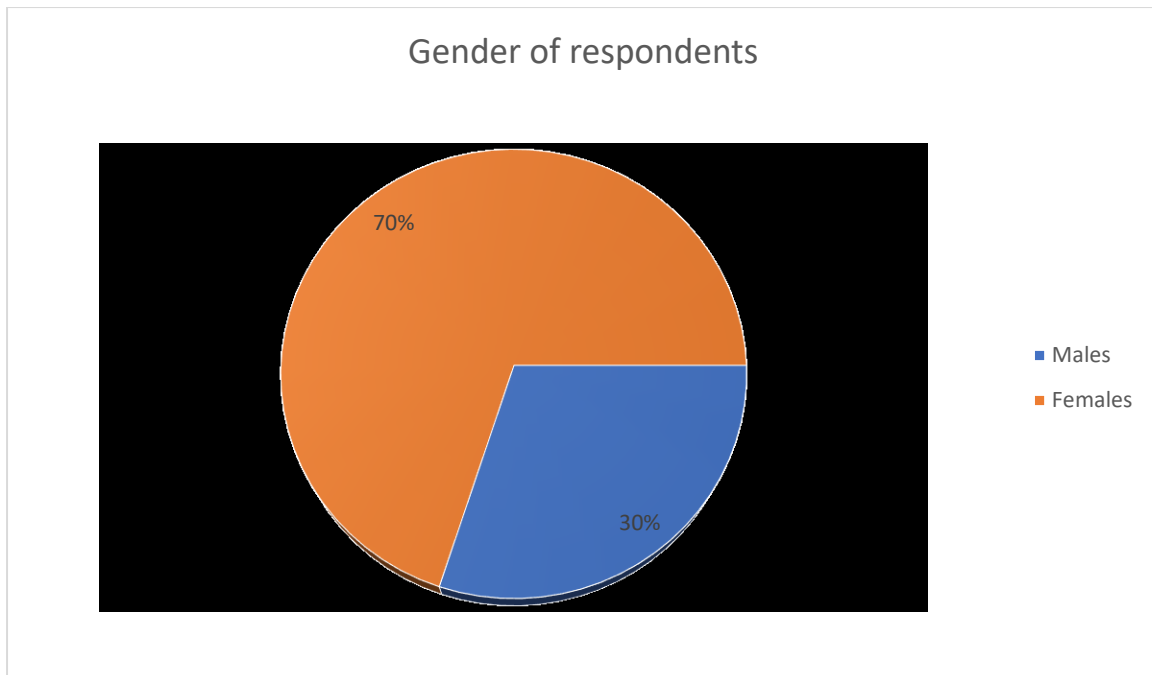


Figure 4.1: Gender of respondents (N=12)

The NLSA library staff participated in the study. This involved library management and librarians. The results showed that there were more females than males. Figure 4.1 revealed more female 7/10 (70%) than male 3/10 (30%) questionnaire respondents. Within the qualitative data, only two males from a total of 4 were part of the interviews and there were zero female participants.

4.3.2 AGE GROUP OF RESPONDENTS

The respondents were required to indicate their age group and the findings are presented in figure 4.2 below.

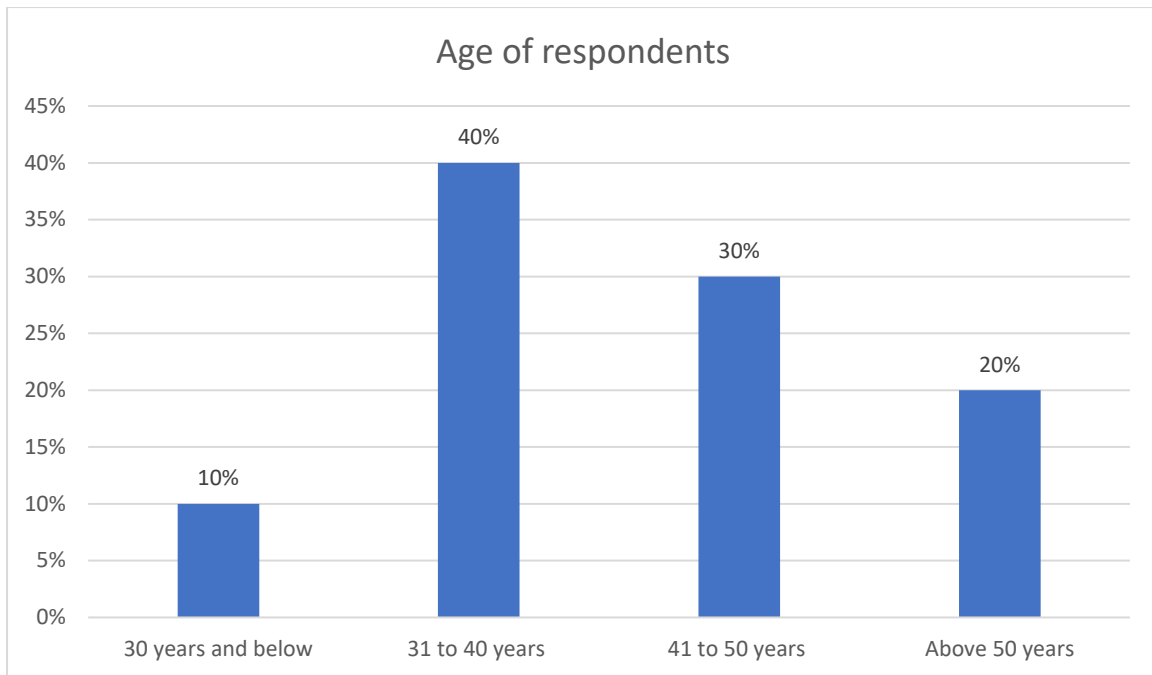


Figure: 4.2: Age of respondents (N=12)

The results shown in figure 4.2 reflect quantitative data from 10 questionnaire participants. The results indicate that most of the respondents' age ranged from 31 to 40 years (40%), although 3 (30%) indicated that their age was 41 to 50; 2 (20%) indicated above 50 years and the least represented age group was 30 years and below with 1 (10%). The results from the interviews, the qualitative data, indicated that out of the 2 interviewees, one participant's age group ranged from 31 to 40 and the other participant ranged from 40 to 50 years.

4.3.3 HIGHEST EDUCATION LEVEL ATTAINMENT

Participants were also asked to also indicate their education attainment. Their responses are presented on figure 4.3 below.

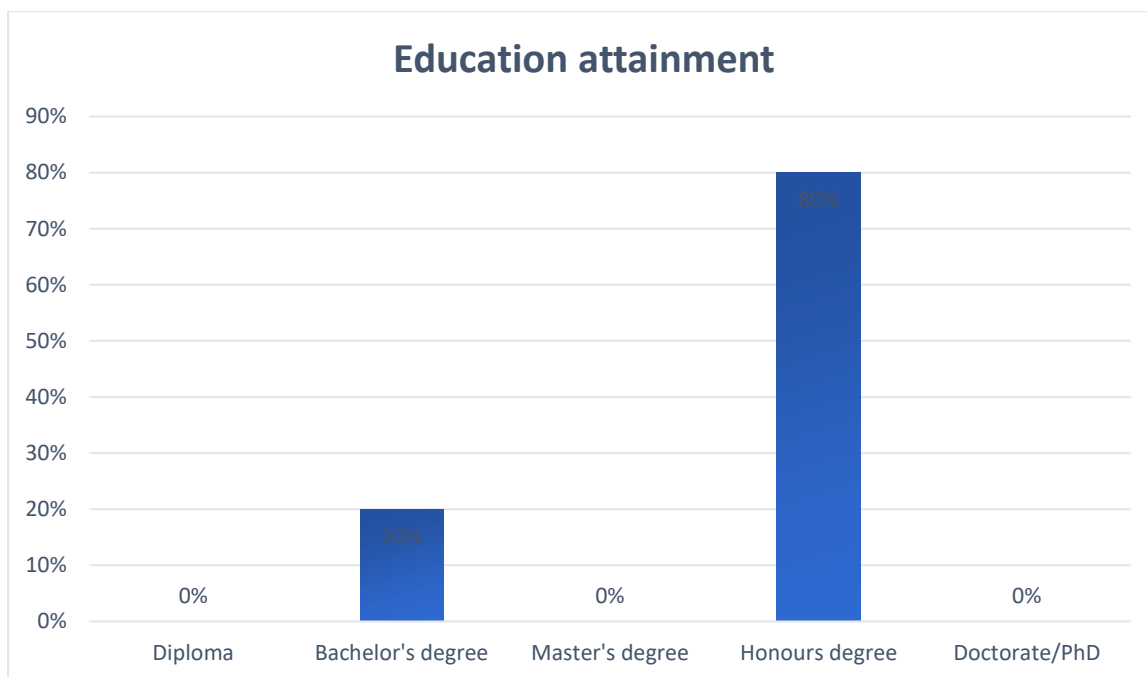


Figure 4.3: Highest education level attainment (N=12)

The findings as shown in figure 4.3 above, reveal that the majority 8 (80%) of librarians obtained an honours degree in librarianship. This was followed by 2 (20%) librarians with a bachelor’s degree in librarianship, making a total of 100%. Within the qualitative data obtained from 2 (50%) library management staff, 1 (25%) management staff had a bachelor’s degree while the other management staff interviewed had a Doctorate/PhD in librarianship 1 (25%).

4.4 FINDINGS

The following section represents the findings from both the questionnaire and interviews conducted. Respondents were asked questions about their preparedness towards the 4IR. The questions asked were framed based on the Technology Readiness Index (TRI), which measures the level of preparedness/readiness to use innovative technologies. This was measured using the TRI’s four construct: innovativeness, optimism, discomfort and insecurity. Participants were asked about 4IR preparedness, 4IR perceptions, perceived fears and scepticism towards the 4IR and some of the challenges faced in preparing for the 4IR. The interview schedule and questionnaire provided the full details (see Appendix A)

4.4.1 ASSESSMENT OF TECHNOLOGY READINESS (OPTIMISM AND INNOVATIVENESS)

To access the elements that influence technology acceptance, the participants were asked 12 questions. Six questions accessed innovativeness and the other six questions were asked to access optimism in using 4IR technologies. The participants were asked to choose the appropriate answer based on the Likert scale questionnaire (see the full details of the questionnaire as Appendix B)

4.4.1.1 INNOVATIVENESS

In the questionnaire, question 4 was asked to discover how prepared the librarians of the NLSA, Pretoria were for the 4IR. The findings are presented in Table 4.2:

Table 4.2: Preparedness of librarians for 4IR (N=10)

	Statement	Strongly Agree	Agree	Neutral	Strongly Disagree	Strongly Disagree
1	I am knowledgeable about high-tech technology and people usually come to me for advice on new technology.	2 (20%)	3 (30%)	4 (40%)	1 (10%)	-
2	In general, I am usually the first to have knowledge about new technologies when they appear.	1 (10%)	2 (20%)	4 (40%)	3 (30%)	-
3	I can usually figure out new high-tech products and services without help from others.	2 (20%)	3 (30%)	3 (30%)	2 (20%)	-
4	I keep up with the latest technological developments in my area of work.	1 (10%)	3(30%)	5 (50%)	1 (10%)	-
5	I enjoy the challenge of figuring out high-tech technology.	2 (20%)	5 (50%)	1 (10%)	1 (10%)	-
6	I find I have fewer problems with making high tech technology work for me.	2 (20%)	4 (40%)	4 (40%)	-	-

The findings revealed that the majority 50% of the participants agreed with the statement that they were knowledgeable about high tech technology, while 40% was neutral and only 10% disagreed. A majority of 40% was also neutral to the statement pertaining to being the first to have knowledge about new technologies when they appear, 30% agreed and 30% disagreed. A majority of 40-70% agreed that they could figure out high-tech technology, keep up with the latest technology, figure out high tech technology and had fewer problems with making high-tech technology work for them. Only a percentage ranging from 10-50% was neutral, while a minority 10-30% disagreed. The corresponding interview data are presented next.

In the qualitative interviews, it was revealed that all the respondents 50% agreed that the NLSA was ready for the 4IR.

Table 4.2.1: Preparedness of 4IR (N=2)

Respondent	Significant statement	Code
<i>First respondent:</i>	<i>“The NLSA is ready for the 4IR; the library supports the 4IR innovations. For example, the NLSA has embarked on digitisation projects making the NLSA documents available online. This project aims at enhancing the preservation of and access to the national documentary heritage of South Africa. The library is 90% prepared for the 4IR and is excited with the innovations of the 4IR. The NLSA anticipate that the 4IR technologies will make the NLSA standout”.</i>	Ready, supports, innovation digitization projects, prepared, standout The NLSA is ready/prepared for the 4IR, the library supports the 4IR innovations, and the NLSA has embarked on digitisation projects to enhance and preserve the NLSA documents and make library documents available online. The NLSA anticipate that the 4IR innovations will make the NLSA stand out.
<i>Second respondent:</i>	<i>“Based on my own assessment, to some extent the</i>	Prepared, modernisation, digitization, business

	<p><i>NLSA is prepared. I am basing the view on the fact that there is a business strategy 2022-2025 of five years which is centered on modernization, digitalisation and 4IR, where key performance areas are geared around adopting and implementing 4IR technologies in the library. The library is ready in adopting 4IR they have certain elements in the ICT section which have decided to have talks about adopting 4IR”.</i></p>	<p>strategy 2022-2025, adopting, implementing.</p> <p>It was also indicated that the NLSA is indeed prepared for the 4IR. The library has a business strategy for 2022-2025 centered towards modernizing, digitisation the NLSA. The business strategy is geared around adopting and implementing 4IR technologies within the NLSA.</p>
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4.4.1.2 OPTIMISM

Question 4.1 asked the librarians to indicate how they perceived the use of the 4IR. The results are presented in Table 4.3 below.

Table 4.3: Perception of the use of 4IR (N=10)

	Statement	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
1	I look forward to using 4IR technology because it will contribute to better job execution	5 (50%)	5 (50%)	-	-	-
2	New technology will give me more freedom of mobility at work	7 (70%)	3 (30%)	-	-	-

3	4IR technology will give me more control over daily responsibilities at work	6 (60%)	4 (40%)	-	-	-
4	4IR technology will make me more productive at work	7 (70%)	2 (20%)	1 (1%)	-	-
5	4IR technology will enable the possibility and freedom to work anywhere	8 (80%)	2 (20%)	-	-	-
6	4IR technology can make me more efficient in my occupation	7 (70%)	2 (20%)	1 (1%)	-	-

The finding in Table 4.3 highlight how the librarians perceived the use of 4IR technologies. It was revealed that 100% of the librarians agreed that 4IR technologies will contribute to better job execution, give freedom of mobility, give control over daily responsibilities and enable freedom to work anywhere. Moreover, a majority of 90% agreed that 4IR technologies will make them more productive at work and make them more efficient in their occupation, while a minority of 10% was neutral to the statements.

The participants in the interview shared how they perceived the use of the 4IR, as captured in Table 4.3.1 below:

Table 4.3.1: Perception of the use of 4IR (N=2)

Respondent	Significant statement	Code
<i>First respondent</i>	<i>“The 4IR technologies promise to be effective, this will enable employees/people to work from home, for example, signature applications/generators can allow people to sign documentations/documents anywhere. This eliminates the need for employees to go to the office to physically sign. The 4IR technologies can contribute to</i>	Effective, signature applications, efficiency and freedom of mobility. It is perceived that the 4IR technologies promise to be effective and will enable the possibility to work from home. For example, signature applications/generators eliminate the need for employees to physically sign documents at the

	<i>more work efficiency and freedom of mobility”.</i>	office. This therefore can contribute to work efficiency and freedom of mobility.
<i>Second respondent :</i>	<i>“I believe there is greater appetite to modernize and digitise the NLSA with 4IR technologies; the library has embraced revolution and has received the 4IR well. It is something management talks about and we have projects that push for 4IR adoption. The 4IR technologies promise positive efficiency to job execution”.</i>	Appetite, modernize, digitise, embrace, efficiency and job execution The participant indicated that there is a greater appetite to modernise and digitise the NLSA with 4IR technologies. The library has embraced the 4IR revolution and perceive that the 4IR technologies promise positive efficiency to job execution.

4.4.2 ASSESSMENT OF DISCOMFORT AND INSECURITY

The components of discomfort and insecurity were used to establish factors that inhibited librarians from accepting technology. Furthermore, the assessment of discomfort and insecurity was divided into two, 12 questions. Six questions were asked to ascertain the element of discomfort and six questions for the element insecurity. Participants were asked to choose the appropriate answer based on the Likert scale questionnaire.

4.4.2.1 DISCOMFORT

In Section 3 of the questionnaire, the participants were asked about their perceived fears and scepticism associated with adopting and using 4IR technologies at the National Library. The findings from the 10 librarians are thus presented in Table 4.4.

Table 4.4: Perceived fears and scepticism of adopting and using 4IR technologies (N=10)

	Statement	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
1	Sometimes, I think 4IR technology systems are not designed for ordinary people like me	-	1 (10%)	1 (10%)	6 (60%)	2 (20%)
2	It is embarrassing when I have trouble with high-tech gadgets while people are watching	2 (20%)	3 (30%)	2 (20%)	1 (10%)	2 (20%)
3	There should be more caution in replacing important people tasks with technology because new technology is not dependable	3 (30%)	1 (10%)	4 (40%)	2 (20%)	-
4	Technology always seems to fail at the worst possible time	2 (20%)	6 (60%)	2 (20%)	-	-
5	Many new technologies have health or safety risks that are not discovered until people have used them (eye, back and wrist problems)	3 (30%)	3 (30%)	4 (40%)	-	-
6	Advanced technologies (e.g. 4IR) require extensive technological skills	4 (40%)	5 (50%)	1 (10%)	-	-

The above table shows that a majority of the participants (80%) disagreed that technology is not designed for ordinary people, while a minority of 10% was neutral and 10% agreed. It was also noted that a majority of 50% found it embarrassing to face difficulties using high-tech technology in front of clients, 30% disagreed with the statement, while 20% was neutral. A shared percentage of 40% agreed and were neutral to the statement that there should be more caution in replacing people's tasks with technology because technology is not dependable,

while a minimum of 20% disagreed. It was also found that a majority of 60-90% agreed that technology always seems to fail at the worst time, has health and safety risks, and that advanced technologies (e.g. 4IR) require extensive technological skills. A minority of 10-40% was neutral to the mentioned statements.

4.4.2.2 INSECURITY

The participants were further asked to respond to some of the possible insecurities they had about adopting and using 4IR within the National Library. Table 4.5 below entails six statements and the findings.

Table 4.5 Perceived fears and scepticism of adopting 4IR technologies (N=10)

	Statement	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
1	People are too dependent on technology to do things for themselves.	1 (10%)	6 (60%)	2 (20%)	1 (10%)	-
2	Too much technology (e.g. 4IR) distracts people to a point that is harmful.	-	7 (70%)	2 (20%)	1 (10%)	-
3	Technology such as robots will lower the quality of relationships by reducing personal interactions.	4 (40%)	4 (40%)	1 (10%)	1 (10%)	-
4	The human touch is very important and advanced technology eliminates that factor.	1 (10%)	8 (80%)	1 (10%)	-	-
5	When I do work, I prefer talking to a person rather than interacting with an advanced automated system.	3 (30%)	3 (30%)	3 (30%)	1 (10%)	-

6	With new technology, you need to check carefully that the system is not making mistakes.	-	7 (70%)	3 (30%)	-	-
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The findings in Table 4.5 indicate that a majority of 60-90% agreed with all the above statements, which sought to discover librarians’ insecurities about adopting 4IR technologies. It was echoed by the participants that people are too dependent on technologies to a point that is harmful. For instance, technologies are seen to reduce human interactions and that technology requires consistent checks to avoid mistakes. A minimum of 10-30% of the participants was neutral while a minority of 10% disagreed that people depend too much on technology. Some felt that too much technology is distracting, and robots will lower the quality of human relationships and preferred human interaction over automated systems.

The research objectives addressed by the qualitative approach also involved qualitative analysis. For instance, the interview respondents were asked about their perceived fears and scepticism associated with adopting the 4IR technologies at the NLSA, Pretoria. Responses provided by respondents are presented in Table 4.5.1 below:

Table 4.5.1: Perceived fears and scepticism of adopting 4IR technologies (N=2)

Respondent	Significant statement	Code
<i>First respondent:</i>	<i>“It is quite normal to have fears especially when it comes to adopting or implementing a new technology. For example, some of the fears may include 1. Sustainability- is the 4IR technologies sustainable, more especially the rise of cost 2. Health risks- physical strains on the human body such as eye problems, back problems etc. and lastly security risks- will it be safe to use these technologies? We look at security risk such as cyber security vulnerability,</i>	Sustainability, health risks, security risks. Participants expressed that there is a fear that 1. 4IR technologies might not be sustainable, for example the rise in costs. 2. That 4IR technologies might cause health risks, physical strain on the body, eye and back problems. 3. Security risks,

	<i>system attacks, the more technology evolves the vulnerable organizations are due to the growth of hackers”</i>	looking at risks such as cyber security vulnerability, system attacks especially with the growth of hackers.
<i>Second respondent:</i>	<i>“Job loss is one of the fears that most staff encounter when they think about 4IR technologies. But library management has engaged with staff including stakeholders about the 4IR and also invited the University of Pretoria to share information on the 4IR technologies. Staff members were given the opportunity to express their sentiments around the 4IR drive. Staff was informed about 4IR, that as much as we are adopting the 4IR technologies it does not threaten their job but increases skills to be able to use the technologies”.</i>	Job loss It was expressed that job loss is one of the fears that most staff encounter when they think about 4IR technologies.

4.5 CHALLENGES

Questionnaire participants were given a list of challenges drawn from related literature and relevant constructs of the adapted theoretical framework and asked to select the most appropriate answer based on the Likert scale. They were to indicate whether they agreed or not with the challenges presented. The full details of the questions are available in Appendix B

Table 4.6: Challenges (N=10)

	Statement	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
1	Inadequate Information Technology (IT) infrastructure	7 (70%)	2 (20%)	1 (10%)	-	-
2	Lack of innovative leaders	6 (60%)	2 (20%)	2 (20%)	-	-

3	Lack of adequate and sustainable funding	5 (50%)	3 (30%)	2 (20%)	-	-
4	Unstable electricity supply poses a challenge	3 (30%)	3 (30%)	3 (30%)	1 (10%)	-
5	Resistance to change, inadequate skills and competencies	4 (40%)	4 (40%)	1 (10%)	1 (10%)	-
6	Lack of exposure to international standards	5 (50%)	2 (20%)	1(10%)	2(20%)	-

Table 4.6 presents the findings on the librarians’ challenges against their preparedness for 4IR. The findings indicated that most librarians agreed that inadequate IT infrastructure was a challenge by 90%. 80% agreed that the lack of innovative leaders was a challenge, and 80% also agreed that there was a lack of adequate and sustainable funding. 60% of the respondents agreed that unstable electricity supply poses a challenge. Another 80% also agreed that resistance to change, inadequate skills and competencies to adopt and use technology cause a challenge. 70% agreed that lack of exposure to international standards was challenging. 10-30% participants were neutral to all the statements while 10-20% disagreed that unstable electricity supply, resistance to change, inadequate skills and competencies and lack of exposure to international standards were challenges that could hinder preparedness for 4IR.

Interview participants were also asked to indicate some of the challenges they consider hindering technology preparation. Below participants indicated the following:

Table 4.6.1: Challenges of interview respondents (N=2)

Respondents	Significant statement	Code
<i>First respondent:</i>	<i>“The challenges that I believe make it difficult to prepare and adopt new technology are: load shedding, staff not willing to use new technologies and staff attitudes negative attitude towards the 4IR”</i>	Load shedding, staff averse/ staff attitude Participant identified challenges considered to hinder technology preparation which include: load shedding, staff averse (staff not willing to use new

		technology) and staff negative attitude towards 4IR technologies.
<i>Second respondent:</i>	<i>“Funding is one of the greatest challenges. In as much as we plan to digitize, modernise and improve efficiency through technology, funding a challenge.</i>	Funding Participants identified that Funding is a challenge to preparing for 4IR.

4.6 ADDITIONAL INTERVIEW ANALYSIS

Some of the additional analysis from the interviews and responses that may not fit above but were very relevant to the study are presented here.

4.6.1 How can these challenges be addressed?

Question 8 from the interview schedule was a continuation of the challenges faced. The respondents were asked how the above-mentioned challenges could be addressed. Their responses are presented below:

First respondent: *“To address the challenge of staff negative attitudes towards new technology, it will be important to teach/educate staff on the developing 4IR technologies. It will be important and also beneficial to the organisation to have formal or informal workshops to help staff develop new knowledge and skills relevant to survive in the 4IR era”.*

Second respondent: *“My perspective is that we can further engage more with those controlling the budget, our mother department, the Department of Sports, Arts and Culture in a formal way and put forth business cases to justify the need for money to implement 4IR innovations. Sell the idea of modernising, digitising the library and infusing the 4IR technologies. Alternatively, we could also engage in having sponsors and partnerships that can help, where we could share how the 4IR can benefit the country and the library”.*

The participants indicated that to address the challenge of staff’s negative attitude towards technology, staff members need to be educated about developing/tending technologies (4IR). This will benefit the organisation. This can be done by organising formal workshops to develop staff members and equip them with adequate skills relevant in the 4IR era. It was also stated

that communication with relevant departments, sponsors and partnerships will also help combat the challenge of inadequate funding. Financial assistance should be sought to finance the implementation of the 4IR technologies. This could be done by selling the idea of innovation, modernisation and digitisation. This therefore will be beneficial to the country and the libraries.

4.6.2 How does the NLSA plan to implement 4IR technology in the library?

The participants were asked how the NLA plans to implement 4IR technologies in the library. The participants explained that the NLSA has embarked on a digitisation project in an effort to showcase its intention to embrace and adopt 4IR technologies. The digitisation projects aim to make NLSA documents available online. The library planned on rolling out new technologies and was on its way to adopting 4IR technologies. The ICT department within the NLSA also had projects geared towards innovation and implementation of the 4IR technologies.

First respondent: *“As I have mentioned before, the NLSA has embarked on a digitisation project in the effort to showcase its intention to embrace and adopt 4IR-related technologies. The library plans on rolling out new technologies and the National Library is well on its way to adopting 4IR technologies although not exactly there yet”*

Second respondent: *“The NLSA strategy including the ICT department has projects geared towards innovation and implementation of the 4IR. The library is digitising its library documents with the aim to make them available online”.*

4.7 SUMMARY

This chapter presented the research findings. Quantitative data were collected through questionnaires whereas qualitative data were collected through interviews. The study included 10 librarians and 2 library management staff of the NLSA, Pretoria. The quantitative findings were presented in figures and tables, while the qualitative data were presented in a narrative form. The four research questions underpinning the study and the adapted theoretical framework framed the headings and subheadings under which the findings were presented. The fundamental findings indicated that librarians were prepared for the emerging 4IR technologies, and that there existed an overall positive perception towards 4IR technologies. However, some participants were sceptical about the 4IR technologies. They also indicated challenges that they felt hindered 4IR implementation. The discussions and interpretations of the study’s findings are presented in Chapter 5.

CHAPTER FIVE: DISCUSSION AND INTERPRETATION OF FINDINGS

5.1 INTRODUCTION

This chapter discusses and interprets the study's findings that were presented in Chapter Four. The discussion is structured around the core findings of the study's research questions. The chapter encapsulates the study's responses to the research questions and relates the outcomes to literature. According to Leedy and Ormrod (2021), discussing the research findings means relating the findings to the original research questions, problem, objectives and literature reviewed. MaCombes (2022) states that the interpretation and discussion of findings involve delving into the study's meaning, importance and relevance. It focuses on explaining and evaluating what the researcher found, showing how it relates to their literature review and dissertation topic, thereby making an argument in support of their overall conclusion (MaCombes, 2022). It should be noted, as stated in Chapter One, that the concept of 4IR does not occur much in the literature relating to public libraries; hence, the literature reviewed included all types of libraries. The research aimed to investigate public libraries' preparedness for the 4IR, using the NLSA, Pretoria as a case study. To achieve its purpose, four research questions were put forward.

The specific research questions addressed were:

1. How prepared is the NLSA, Pretoria, for the 4IR?
2. How do librarians at the NLSA, Pretoria, perceive the use of the 4IR?
3. What are the perceived fears and scepticisms of librarians associated with adopting the 4IR technologies at the NLSA, Pretoria?
4. What are the challenges to the preparedness of the NLSA, Pretoria, for the 4IR?

The chapter is organised as follows: the summary of the findings, discussion of the research findings as per the research questions and the summary of the chapter, respectively.

5.2 SUMMARY OF FINDINGS

The summary of the findings is presented below. The research questions listed above framed the structure for the discussion.

Research question one sought to find out how prepared the NLSA is for the 4IR. The results indicated that most librarians at the NLSA were prepared for 4IR. NLSA librarians have knowledge of the trending 4IR technologies, can utilise high-tech technology and enjoy learning new technology. Research question two dealt with librarians' perception towards the 4IR. It was also found that most librarians perceived the 4IR positively. The librarians believed that the 4IR technologies would enable them to be productive and more efficient in their occupation. They also thought that the 4IR technology would enable more freedom of mobility at work, give them more control over daily responsibilities and enable productivity at work. The third research question determined the librarians' possible fears and/or scepticism towards the 4IR technologies. From the data, it was identified that librarians had a number of fears and notable scepticism towards the 4IR technologies. For example, 4IR technologies might fail at the worst time, may have health risks, and requires extensive skills that eliminate the human touch, interactions and relationships. The last research question identified some challenges that might hinder technology preparedness. The lack of Information Technology (IT) infrastructure, insufficient funding, and unstable electricity supply, resistance to change, lack of skills/competencies of individuals and lack of exposure to international standards were some of the challenges that the librarians thought might set back 4IR preparedness.

5.3 DISCUSSION OF FINDINGS PER RESEARCH QUESTION

The presentation below is framed based on the study's research questions. By way of explanation, each research question is outlined, and outcomes are discussed.

5.3.1 How prepared is the National library of South Africa (NLSA), Pretoria, for the Fourth Industrial Revolution (4IR)?

In assessing the element of innovativeness (see Appendix B), it was discovered that the majority of the librarians at the NLSA were prepared for the 4IR. Most librarians indicated that they were knowledgeable about trending high-tech technologies, and could figure out new technology. They also enjoyed the challenge of figuring out high-tech technology and experienced fewer problems when making technology work for them. However, there was also a majority of the participants who expressed neutrality about keeping up with the latest technology. It was a bit concerning that there was a minority that varied about the statement presented (see Appendix B). The minority disagreed that they keep up with the latest technology. However, the majority was clear that the librarians at the NLSA were prepared for

the 4IR. It was also noted that the NLSA supports 4IR innovations, and that the NLSA has already embarked on the digitisation project by making library documents available online, as indicated by the interview participants.

The study affirms the findings of Tella *et al.* (2022) that most libraries in Nigeria are ready for the revolution and identified technologies that some libraries have implemented. These technologies include automation of services, digitisation of library documents (e-resources, e-books and e-journals) and the creation of an online public access catalog (OPAC) (Tella, 2022). The study also affirms the finding of Ocholla and Ocholla (2020) that advanced libraries in South Africa are prepared and responding well to the 4IR, through innovation and creativity. Similarly, the study found that the NLSA is prepared, supports modernisation and innovations of the 4IR and is on the journey to digital transformation.

Owolabi *et al.* (2022) investigated the level of readiness of digital infrastructure, policy framework and human capacity in some university libraries in Nigeria. It was revealed that there was a lack of digital infrastructure, no policy framework to guide 4IR adoption and there was a lack of human capacity to operate 4IR technologies. Owolabi *et al.* (2022) revealed that the readiness of some university libraries in Nigeria towards the adoption and use of robotic technologies was essentially nothing to write about. This is also supported by Tella (2020), shown that the majority of African countries lack the requisite infrastructure and regulations to help encourage the employment of robotic technologies despite the presence of human resources. The author reported that university libraries in the country were not ready to adopt and use 4IR technology, despite the high benefits that 4IR technologies offer in library operations.

5.3.2 How do librarians at the NLSA, Pretoria, perceive the use of the Fourth Industrial Revolution (4IR)?

In terms of optimism, it was noted that librarians perceived 4IR technology positively (see Appendix B). The librarians looked forward to using the 4IR technologies and thought they will contribute to better job execution. Librarians also thought that the 4IR technology will also enable more freedom of mobility at work, give them more control over daily responsibilities and enable productivity at work. However, a minority of the participants were neutral that 4IR technology will make them more productive and efficient in their occupation. However, neutrality could mean that the participants were uncertain of the possible outcome. Interview

participants also indicated that 4IR technologies will enable the ability to have efficiency of job execution and freedom of mobility. For example, working from home, signature applications which will eliminate the need to physically go to work. The results therefore implied that with the integration of 4IR technologies in the library, operations and services will increase, reduce and improve job execution, tasks and provide efficiency in the workplace.

The study confirms the findings of Tella *et al.* (2022) that librarians and archivists are aware of 4IR technologies, their adoption and use in both libraries and archives. There is a positive perception of 4IR block chain technologies, accompanied by a belief that they can better assist them efficiently with job execution. In another study, Tella *et al.* (2022) similarly revealed that librarians perceive that 4IR applications will reduce work routine, enable librarians to archive many tasks within a limited time-frame and make library operations easier. The authors further reported that use of 4IR technologies can help libraries streamline process to increase accountability and reproducibility, as well as provide the possibility of enhance compliance monitoring.

The study also discovered that librarians at the NLSA believe that 4IR technology promises to be effective and that the NLSA has an appetite for it. The 4IR technology can contribute to more work efficiency and allow freedom of mobility.

5.3.3 What are the perceived fears and scepticism of librarians associated with adopting the 4IR technologies at the NLSA, Pretoria?

The element of discomfort (see Appendix B) revealed that a significant number of the participants believed that 4IR technologies are not designed for ordinary people. They found it embarrassing to encounter trouble with high-tech technology while other people were watching them. Most respondents agreed, while a minority were neutral that there should be caution in replacing important people tasks with new technology, as technology is not always dependable. The majority of librarians also indicated that they feared that high-tech technology might fail at the worst possible time, while a minority were neutral to the statement. Some respondents are sceptical towards 4IR technology, as they believed it might contribute to health risks issues, such as eye, back, and wrist problems. It was further proffered that 4IR technology requires extensive technological skills. Additionally, it was indicated from the interviews that 4IR technologies might not be sustainable due to the rise of cost, which make new technologies expensive. 4IR technology might cause health risks, job loss, as well as security risks, for

example, the system might be vulnerable to system attacks and hackers. The discussion of perceived fears and scepticism further continues with the element of insecurity below (see Appendix B).

On the element of insecurity, it was discovered that most participants feared and were also sceptical of 4IR technology. They revealed that people tend to depend so much on technology to a harmful point. It was indicated that an excessive use of technology eliminates the human touch, interactions and relationships. Findings also revealed that the respondents found that high-tech technology requires consistent attention to avoid system mistakes, contributing too much work. A majority also indicated that they feared talking to automated systems and preferred human interaction, while a minority disagreed. Overall, this indicated some fear and scepticism towards 4IR technology. However, it is quite normal to have fears about adopting technology, as elements such sustainability, security, health risks, and system attacks can occur. The study's findings affirm those of Nikko and Okunghae (2021), that librarians and policy makers are anxious about adopting the 4IR technologies. This therefore indicates scepticism and resistance to change in utilising new trending technologies by librarians (Nikko & Okunghae, 2021). Moreover, Yusuf *et al.* (2022); Abayomi *et al.* (2021) revealed that librarians also fear that 4IR technologies such as AI might take their jobs due to their robustness and adaptability. Similarly, in this study, the fear of job loss was confirmed during the interview session (see Appendix B).

5.3.4 What are the challenges to the preparedness of the National Library of South Africa (NLSA), Pretoria, for the Fourth Industrial Revolution (4IR)?

From the data collected, participants identified a number of challenges as stumbling blocks to technology preparedness. The majority of participants indicated that inadequate infrastructure and a lack of innovative leaders caused a challenge to technology preparedness. They also specified that the lack of adequate, unsustainable funding and an unstable electricity supply make it difficult to prepare for new and exciting technology. Resistance to change, lack of skills/competencies of individuals and lack of exposure to international standards also hinder preparedness for 4IR. Similarly, interview participants mentioned that load shedding, staff averse, funding are challenges towards preparedness.

The study's findings correspond with those of Nikko and Okuonghae (2021) who found that challenges militating against effective crystallisation of 4IR in university libraries included:

financial constraints, inadequate infrastructure, resistance to change, inadequate skills and competencies, security and intrusion issues, and lack of exposure to international standards. Similarly, the study's findings also correspond with those of Shastri and Chudasma (2021). In the process of technology preparedness and implementation, lack of manpower, inadequate IT infrastructure, lack of Information Communication skills, lack of innovative leaders, and insufficient budget are among the many challenges libraries experience in adopting technology. From the data collected, the study also discovered similar challenges. Ogunjimi *et al.* (2021) also revealed that the lack of skilled workforce, poor infrastructure, poor funding and unreliable electricity power are some of the challenges encountered in University libraries in Nigeria. This indicates that libraries face many challenges that make it difficult for them to prepare, adopt and implement technology.

In contrast, Oghenetega, Umeji and Obue (2014) pointed out other challenges that are experienced by libraries and librarians in the adoption of technologies, poor cultural maintenance, poor networking, lack of trained staff, illiteracy, poverty (cost), and policy structure of the government, political factors, economic factors, cultural factors and technological factors. Furthermore, Sibiyana and Nqulube (2023) identified that librarians do not have technical science skills, experience and qualifications, and for most, such skills were never their subjects from basic education right through tertiary education. Mohideen *et al.* (2022) also revealed that lack of new IT skills, smart resources and lack of trust from stakeholders, experts and competencies of librarians hinder the adoption of 4IR in libraries. This therefore, indicates that not only technical issues mentioned in the study hinder technology preparedness, but other issues also pose a challenge to the preparedness for new technologies in the library.

Theoretically, the findings of the study link with the TRI (Technology Readiness Index) that underpinned the research study. The TRI refers to people's propensity to embrace and use cutting-edge technology, a combination of mental motivators and inhibitors (Parasuraman & Colby, 2015). The theoretical framework uses four constructs: innovativeness, optimism (motivators), discomfort and insecurity (inhibitors). The study revealed that the NLSA is ready for the 4IR. This was influenced by the factors such as innovativeness and optimism among librarians. The librarians indicated that they keep up with the latest technologies and positively perceive the 4IR as benefit to them in their job execution. However, while there were significant positive feelings towards the new 4IR technologies, there were also (minority)

negative feelings towards 4IR technologies, as indicated by the participants' discomfort and insecurity. Librarians indicated that they were also sceptical of the emerging technologies of the 4IR, and challenges to the preparedness for the 4IR were indicated. Thus, the theoretical framework used enabled the possibility to investigate the readiness of the NLSA for the 4IR, using effectively the constructs of the index to evaluate the preparedness of NLSA.

5.4 SUMMARY OF THE CHAPTER

In summary, the NLSA library staff are innovative and prepared for the 4IR. They are aware of the 4IR trends and are capable of using technology. They have a positive perception towards 4IR technologies and believe that 4IR technologies will enable efficiency in their workplace. When people positively perceive and feel secure about technology usage, they can learn to cope with the issues relating to technology (Khan *et al.*, 2022). It was discovered that there is fear and scepticism towards 4IR technologies, with regards to health risks, the elimination of the human touch, and the possibility of technology failing at the worst possible times. Like any technology, there is always a fear that it could be misused; however, technology in its own right is not dangerous; rather, its use can be (Faraboschi, 2022). The study also identified some challenges that librarians indicated might hinder technology preparedness at the NLSA. Overall, lack of Information Technology (IT) infrastructure, insufficient funding, resistance to change, lack of skills and competencies of individuals were of a high percentage.

CHAPTER SIX: MAIN FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

This chapter outlines the conclusions and recommendations of the study based on the research questions and results of the study, which were analysed and discussed in Chapters Four and Five. The study aimed to investigate public libraries' preparedness for the 4IR through the lens of the NLSA, Pretoria. The study's research objectives were to:

1. Ascertain the preparedness of the NLSA, Pretoria in adopting the Fourth Industrial Revolution (4IR).
2. Investigate perceptions of librarians of the use of 4IR technology at the NLSA, Pretoria.
3. Identify the challenges to the preparedness of the NLSA, Pretoria, for Fourth Industrial Revolution (4IR).

The specific research key questions addressed were:

1. How prepared is the NLSA, Pretoria, for the Fourth Industrial Revolution (4IR)?
2. How do librarians at the NLSA, Pretoria, perceive the use of Fourth Industrial Revolution (4IR)?
3. What are the perceived fears and scepticisms of librarians associated with adopting the 4IR technologies at the NLSA, Pretoria?
4. What are the challenges to the preparedness of the NLSA, Pretoria, for the Fourth Industrial Revolution (4IR)?

The study was grounded on the TR index. TRI measures people's propensity to embrace and use cutting-edge technologies (Parasuraman 2000, p. 308). TRI 2.0 is based on positive and negative technology related beliefs, optimism, innovativeness, insecurity and discomfort (Parasuraman & Colby, 2015). For the study, optimism and innovativeness helped address librarians' preparedness for the 4IR by establishing librarians' attitude towards technology and assessing the elements that influence technology acceptance. The components of discomfort and insecurity were used to establish factors that inhibited librarians from accepting technology. Moreover, the constructs shed new light on some of the challenges librarians face regarding applying technologies within the library. This chapter begins with a summary of the

study's chapters, followed by the summary of the main findings and ends with the conclusions and recommendations derived from the study's findings.

6.2 SUMMARY OF THE STUDY

Chapter One provided an overview of the study. The chapter briefly introduced the 4IR and its implications to libraries. It also elucidated the study's context, background, a brief background of the NLSA, the problem statement, research objectives and research questions. It further stated the limitations and significance of the study. The study adapted the Technology Readiness Index (TRI) conceptual framework, briefly introducing the research design and methodology. The chapter ended with an outline of other chapters following it.

Chapter Two presented the literature review, evaluating previous and recent studies on libraries, their preparedness and the 4IR. The chapter provided a summary of previous findings on libraries and preparedness to use the 4IR technologies. The chapter ended with a detailed discussion of the adapted conceptual framework that underpinned the study, namely; the Technology Readiness Index (TRI).

Chapter Three comprised the research methodology used in the study. In this chapter, various aspects of the methodology were outlined and discussed. The study adopted the pragmatism paradigm, which uses the mixed method approach. The case study research design was employed, the non-probability and purposive sampling techniques were used to select the participants. Data were collected using a questionnaire and a semi-structured interview schedule. The study's population was the NLSA, Pretoria, librarians and library management staff. The reliability and validity of the research instruments were ensured by pre-testing the research instruments. The research was conducted in accordance with the University of KwaZulu-Natal's research ethics policy, where ethical clearance was granted to conduct the research and COVID-19 protocols followed.

In Chapter Four, the findings from both the questionnaire and interviews were presented. Interviews were conducted with the library management staff, and copies of the questionnaire were distributed among the library staff. The research utilised qualitative and quantitative methods to gather, analyse and interpret data. Findings derived from the interviews data were presented in the form of a text, while findings from questionnaires were presented in tables and

figures. The chapter began with the response rate, followed by the demographics, main findings, challenges, additional interview analysis and lastly, the summary of the chapter.

Chapter 5 discussed the research findings and interpretations of the research questions and summary. The discussion was structured around the core findings of the study's research questions. The chapter deliberated the study's outcome responses to the research questions and related the outcomes to literature. The chapter began with the summary of the findings, followed by the discussion of research findings as per the research questions and ended with the summary of the chapter.

6.3 SUMMARY OF THE MAIN FINDINGS

The main findings derived from the study are presented below. The findings and conclusions are based on the key research questions.

6.3.1 How prepared is the NLSA, Pretoria, for the 4IR?

In assessing the element of innovativeness (see Appendix B), it was found that most of the librarians at the NLSA were prepared for the 4IR. The librarians were knowledgeable about trending high-tech technologies emerging from the 4IR, could figure out high-tech technology and experienced fewer problems when making technology work for them. Some participants indicated neutrality to keeping up with the latest technology. All in all, the above research question revealed that most librarians at the NLSA were prepared for the 4IR. The NLSA supports the 4IR innovations and has already embarked on a digitisation project by making library documents available online.

Librarians play a crucial role in facilitating access to information and knowledge and they need to be equipped to help users navigate the changing landscape of information and technology. Consequently, if librarians are ready for the 4IR, they can provide valuable support to individuals, organisations and communities as they seize the affordances and navigate the challenges industry 4.0 presents. Finally, the readiness of librarians for the 4IR indicates a broader trend of adaptation and innovation in the landscape of information professions. It could result in the development of new services, resources, and systems that better serve the needs of library users in the digital era.

6.3.2 How do librarians at the NLSA, Pretoria, perceive the use of the 4IR?

On the element of optimism (see Appendix B), it was discovered that librarians perceive 4IR technology positively. It was found that librarians at the NLSA perceived the 4IR technology as promising to be effective and with the potential to contribute to more work efficiency, and more freedom of mobility. It was also found from the library management that the 4IR technologies will enable efficiency of job execution and freedom of mobility. The results therefore implied that with the integration of 4IR technologies in the library, operations and services will increase, reduce and improve job execution, tasks and provide efficiency in the workplace. In other words, if most librarians positively perceive the 4IR, it suggests that they see the value of the technologies for their profession and the communities they serve. It is significant because librarians view the 4IR as a tool to help manage and share information more efficiently, making it easier for patrons to access the needed resources. The 4IR is a tool to improve data management, outreach and engagement. It is safe to conclude that the positive perceptions of the 4IR among librarians suggests that libraries will likely continue to evolve and adapt to changing technologies to better serve their user communities.

6.3.3 What are the perceived fears and scepticisms of librarians associated with adopting the 4IR technologies at the NLSA, Pretoria?

The element of discomfort (see Appendix B), uncovered that librarians believed 4IR technologies require extensive technological skills, and that they found it embarrassing when they encountered trouble with high-tech technology while assisting patrons. Results revealed that the librarians were uncomfortable with 4IR technology as they thought that it would eliminate human interaction and replace important tasks with technology.

Librarians indicated that they feared that high-tech technology is not always reliable and that 4IR technologies contribute to health risk issues, such as eye, back, and wrist problems. Perceived fears and scepticism deepened the element of insecurity below (see Appendix B). The results further indicated that librarians had fears about 4IR technologies. The respondents revealed that people tend to depend too much on technology to a harmful point. They believed that 4IR eliminates the human touch, interactions and relationships. Findings also revealed that respondents found that high-tech technology requires constant attention to prevent system mistakes, contributing too much work. A majority of librarians also indicated that they feared talking to automated systems and preferred human interaction instead. This means that there is an issue of trust towards direct use of 4IR technologies. Also, the library management indicated that 4IR technologies might not be sustainable due to the rise in cost, 4IR will cause health

risks, security risks and job loss. The research question revealed that regardless of positive perceptions towards the exciting 4IR technologies, there still existed scepticism and fear towards the 4IR technologies. Overall, while worries about technologies taking over librarians' role are rife and understandable, it is crucial to acknowledge that there are many areas where human expertise, skills and competencies are necessary. Librarians must adapt to these changes, embracing the new affordance to use 4IR to enhance their operations and services to serve users better.

6.3.4 What are the challenges to the preparedness of the NLSA, Pretoria, for the 4IR?

In response to the research question, 90% of the respondents noted inadequate infrastructure, and the lack of innovative leaders (80%) as a challenge to technology preparedness. 80% of the librarians thought that the lack of adequate and unsustainable funding as well as unstable electricity supply at a response rate of (60%), make it difficult to prepare for new and exciting technology. 80% indicated that resistance to change, the lack of skills/competencies of individuals and lack of exposure to international standards (70%) hindered preparedness for 4IR. Interview participant identified challenges considered to hinder technology preparation included: load shedding, staff averse (staff not willing to use new technology), staff negative attitude towards 4IR technologies and lack of funding. Therefore, the research question helped reveal some of the challenges that make it difficult to adopt/prepare for new technologies in the library. Inevitably, the 4IR will have its challenges due to the ever-changing developments and introduction of the new trending technologies. Ultimately, organisations will face challenges of adopting 4IR technologies. Challenges ranging from inadequate infrastructure, funding, electricity supply and lack of skill-sets of staff, among others. Careful planning is needed to mitigate challenges (Kayembe & Nel, 2019). Leaders need to be innovative and provide exposure to new technologies. Librarians should obtain new skills sets to survive within the 4IR to better serve their patrons. Institutions must have long-term suitable funding and electricity back-ups to enable sufficient use of advanced technologies.

6.4 CONCLUSION

The study's conclusion is drawn from the main findings, presented in point form and in a sequence as the research questions outlined above.

In relation to the preparedness of the NLSA for the 4IR, it can be concluded that:

- Librarians are knowledgeable about trending 4IR technologies.

- Librarians are cable of using/figuring out advanced technologies, without many challenges.
- The NLSA supports the 4IR innovations as they have already embarked on digitising library documents to make them available online.
- Librarians are prepared for the 4IR indicating a broader trend of adaptation and innovation with the landscape of information professions.

In terms of the librarians' perception of the 4IR, it is concluded that:

- Librarians positively perceive that 4IR promise to be effective, contributing to better job execution.
- 4IR technologies can contribute to more freedom of mobility and control over daily responsibilities.
- 4IR technologies can increase productivity and allow librarians to be more efficient in their occupation.
- Significantly, librarians view the 4IR as tools to help manage and share information more efficiently, making it easier for patrons to access needed resources.

In terms of librarians' perceived fears and scepticism towards 4IR, it can be concluded that:

- Librarians are sceptical about 4IR technologies as they require extensive technological skills, finding it embarrassing to face challenges while utilising the technologies in front of users.
- Librarians fear that 4IR will eliminate human interaction, touch and relationships.
- There are fears that people depend so much on technology to a harmful point and can contribute to issues such as eye, back, and wrist problems.
- 4IR technologies require extensive attention, contributing to extra work by trying to avoid making mistakes.
- There is a preference to engage with a person rather than interact with an advanced automated system.

In terms of the challenges discovered that were said to hinder technology preparedness, it was concluded that:

- Inadequate Information Technology (IT) infrastructure remained as the most identified challenge.
- 80% of the librarians indicated that the lack of innovative leaders, lack of adequate and sustainable funding, resistance to change, inadequate skills and competencies caused a challenge to technology preparedness.
- There are librarians who considered that the lack of exposure to international standards and unstable electricity supply poses a challenge.

Finally, the study's findings suggested that the librarians at the National Library are prepared for the 4IR. They perceived the 4IR as a positive invention to library as it will contribute greatly to job execution. Although fears, scepticism and challenges were indicated, the NLSA is well on its way to embracing the 4IR. It should, however, be noted that the study was limited to only the NLSA management and librarians, although not all anticipated participants were available to participate, the results of the study are based on the ten librarians who participated in the questionnaires and two managers who were available for the interviews. The results are based on the views of the few willingly available participants and might not be the general majority opinion of the whole organisation of the NLSA library staff.

In conclusion, Ahmat and Hanipah (2018) state that introducing 4IR in libraries would contribute to revising new business models, restructure the business process flow, remaking the job description and job roles. The researcher hoped to contribute to management policies, and practices to enable preparations for better services for the society within the 4IR era.

6.5 RECOMMENDATIONS

The current study recommends that the NLSA should organise workshops to educate staff about the 4IR technology so that there are fewer fears and scepticism towards the 4IR. This will help librarians to be informed and prepared to fully accept 4IR innovations without any fears and or scepticism in utilising 4IR technologies.

Targeted training opportunities should be provided for library staff to have the necessary skills required to fit into the emerging revolution. There should be an encouragement to have a

positive attitude toward the use of technology to combat resistance to change and increase competencies. This is because as technology evolves, librarians/library staff need to acquire skills relevant to the 4IR. As libraries gradually move into adopting 4IR technologies, information professionals should be properly skilled as the world is rapidly becoming digital. Tella (2020) states that, things are changing and that automation is taking the place of human labor as a result of the developments of superior technology, AI and robotics. Hussain (2020) adds that AI and automation process are changing agents in the 4IR, making particular employees inessential and replacing them with new workers with the required skills. Shahzad and Iqbal (2020) state that library professionals should grab proper library automation and digitisation skills to survive in the 4IR era.

Adequate IT infrastructure should be available in the library. This is because inadequate IT remained the most identified challenge making 4IR technology preparedness difficult. Libraries should ensure that they match the rapid tempo of technological advances with the right infrastructures in place (West, 2021).

The current study stressed the essential need for sufficient funding to be allocated for the implementation of 4IR technologies. The study revealed that participants indicated that a lack of sufficient funding hinders technology adoption. The NLSA being the nation's document hub implementing 4IR technologies will benefit the organisation, the country, and its public libraries.

There should be policies that drive the implementation of technology, so that management can incorporate the adoption of 4IR technologies and strive towards innovation. These policies can include guidelines of international standards so that NLSA can be up-to-date with trending technologies. The policies can further include remedies for unstable electricity supply to cover aspect of the business continuity plan.

6.6 SUGGESTION FOR FUTURE RESEACH

Lastly, the study investigated 4IR preparedness in public libraries with the NLSA as a case study since it has the resources and infrastructure to support 4IR at this stage. As the study was limited to the National Library, with a small response rate, it is suggested that further studies be conducted in public/community libraries to expand the scope of 4IR in libraries with a higher/larger sample. Studies can also explore the nature of proper skill sets of librarians within the industry 4.0 era.

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APPENDIX A: INTERVIEW SCHEDULE



College of Humanities: School of Social Sciences

Department of Information Studies

Interview schedule for library managers

Title: Investigating public library preparedness for the Fourth Industrial Revolution: a case study of the National Library of South Africa, Pretoria

Interviewer: Mbalenhle Kekana

Date of interview:

Dear: Respondent

I am Mbalenhle Lucia Kekana, a student at the University of KwaZulu-Natal doing a Master in Information Studies. I would like to ask you a few questions about the study I am conducting on library preparedness for the Fourth Industrial Revolution a case study on the National Library of South Africa. The research is not equating the public library to the National library of South Africa (NLSA). Instead, it wants to use the lens of NLSA in the landscape of the Fourth Industrial Revolution (4IR) to inform and guide a future development and implementation of 4IR in other types of libraries.

As part of the requirements for completing of the Master's qualification, I humbly ask for your participation in my research project by completing this questionnaire. It is 100% guaranteed that all information provided will be used for research purposes only. Your responses will be treated with the utmost confidentiality and will not be linked to any particular respondent or department. I realize there are many other demands on your time, but the results will be beneficial to all stakeholders.

Thank you in advance

KEY RESEARCH QUESTIONS

How prepared is the National Library of South Africa (NLSA), Pretoria, to adopt the Fourth Industrial Revolution (4IR) to enhance library efficiency and effectiveness?

The specific research key questions addressed are:

- i. How prepared is the National Library of South Africa (NLSA), Pretoria, for the Fourth Industrial Revolution (4IR)?
- ii. How do librarians at the National Library of South Africa (NLSA), Pretoria, perceive the use of Fourth Industrial Revolution (4IR)?
- iii. What are the perceived fears and scepticism of librarians associated with adopting the Fourth Industrial Revolution technologies at the National Library of South Africa (NLSA), Pretoria?
- iv. What are the challenges to the preparedness of the National Library of South Africa (NLSA), Pretoria for the Fourth Industrial Revolution (4IR)?

SECTION

1:

DEMOGRAPHICS

1. Gender: Tick as appropriate

Male	<input type="checkbox"/>	Female	<input type="checkbox"/>
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2. Age group: Tick as appropriate

30 years and below	<input type="checkbox"/>	31 to 40 years	<input type="checkbox"/>	41 to 50 years	<input type="checkbox"/>	Above 50 years	<input type="checkbox"/>
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3. What is your highest educational attainment? Tick as appropriate

Diploma	<input type="checkbox"/>
Bachelor's degree	<input type="checkbox"/>
Master's degree	<input type="checkbox"/>

Honours degree	
Doctorate/ PhD	

Other (Specify)

Section 2: Assessment of technology readiness (optimism and innovativeness)

4. How prepared is the National Library of South Africa (NLSA), Pretoria, for the Fourth Industrial Revolution (4IR)?
5. How does the library management of National Library of South Africa (NLSA), Pretoria, perceive the use of Fourth Industrial Revolution (4IR)?

Section 3: Assessment of discomfort and insecurity

6. What are the perceived fears and scepticism associated with adopting the Fourth Industrial Revolution technologies at the National Library of South Africa (NLSA), Pretoria?

Section 4: Challenges

7. What are some of the challenges to the preparedness of the National Library of South Africa (NLSA), Pretoria for the Fourth Industrial Revolution (4IR)?
8. How can these challenges be addressed?

Additional question

9. How does the NLSA plan to implement 4IR technology in the library?

APPENDIX B: RESEARCH QUESTIONNAIRE



College of Humanities: School of Social Sciences

Department of Information Studies

Research questionnaire for librarians

Title: Investigating public library preparedness for the Fourth Industrial Revolution: a case study of the National Library of South Africa, Pretoria

Dear: Respondent

I am Mbalenhle Lucia Kekana, a student at the University of KwaZulu-Natal doing a Master in Information Studies. I would like to ask you a few questions about the study I am conducting on library preparedness for the Fourth Industrial Revolution a case study on the National Library of South Africa. The research is not equating the public library to the National library of South Africa (NLSA). Instead, it wants to use the lens of NLSA in the landscape of the Fourth Industrial Revolution (4IR) to inform and guide a future development and implementation of 4IR in other types of libraries.

As part of the requirements for completing of the Master's qualification, I humbly ask for your participation in my research project by completing this questionnaire. It is 100% guaranteed that all information provided will be used for research purposes only. Your responses will be treated with the utmost confidentiality and will not be linked to any particular respondent or department. I realize there are many other demands on your time, but the results will be beneficial to all stakeholders.

For any queries, do not hesitate to contact us on:

1. Researcher: Mbalenhle Lucia Kekana

Email: mbalenhle.kekana0329@gmail.com



2. Supervisor: Dr Gbolahan Olasina
 Email: olasinag@ukzn.ac.za
 Tel: 033 260 5285

Thank you in advance

Instructions for filling in the questionnaire;

- i) Please tick or mark with an 'X' the applicable answer(s)
- ii) Use the spaces provided to write your answers to the questions. If a question does not apply, please indicate 'N/A'.

SECTION 1: DEMOGRAPHICS

1. Gender: Please tick or mark an 'X' the applicable answer(s)

Male		Female	
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2. Age group: Please tick or mark an 'X' the applicable answer(s)

30 years and below		31 to 40 years		41 to 50 years		Above 50 years	
--------------------	--	----------------	--	----------------	--	----------------	--

3. What is your highest education attainment? Please tick or mark an 'X' the applicable answer(s)

Diploma	
Bachelor's degree	
Master's degree	
Honours degree	
Doctorate/ PhD	

Other (Specify)

SECTION 2: ASSESSMENT OF TECHNOLOGY READINESS (OPTIMISM AND INNOVATIVENESS)

4. How prepared is the National Library of South Africa (NLSA), Pretoria, for the Fourth Industrial Revolution (4IR)? 4IR includes robots, Internet-of-Things, Big Data, 3D/4D printing, Artificial Intelligence, etc.

Innovativeness: Tick each item as appropriate

	Statement	Strongly Agree	Agree	Neutral	Strongly Disagree	Strongly Disagree
1	I am knowledgeable on high-tech technology and people usually come to me for advice on new technology					
2	In general, I am usually the first to have knowledge about new technologies when they appear					
3	I can usually figure out new high-tech products and services without help from others					
4	I keep up with the latest technological developments in my area of work					
5	I enjoy the challenge of figuring out high-tech technology					
6	I find I have fewer problems with making high tech technology work for me					

- 4.1 How do librarians at the National Library of South Africa (NLSA), Pretoria, perceive the use of the Fourth Industrial Revolution (4IR)? 4IR includes robots, Internet-of-Things, Big Data, 3D/4D printing, Artificial Intelligence, etc

Optimism: Tick each item as appropriate

	Statement	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree

1	I look forward to using 4IR technology because it will contribute to better job execution					
2	New technology will give me more freedom of mobility at work					
3	4IR technology will give me more control over daily responsibilities at work					
4	4IR technology will make me more productive at work					
5	4IR technology will enable the possibility and freedom to work anywhere					
6	4IR technology can make me more efficient in my occupation					

SECTION 3: ASSESSMENT OF DISCOMFORT AND INSECURITY

5. What are the perceived fears and scepticism of librarians associated with adopting the Fourth Industrial Revolution technologies at the National Library of South Africa (NLSA), Pretoria?

Discomfort: Tick each item as appropriate

	Statement	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
1	Sometimes, I think 4IR technology systems are not designed for ordinary people like me					
2	It is embarrassing when I have trouble with high-tech gadgets while people are watching					

3	There should be more caution in replacing important people tasks with technology because new technology is not dependable					
4	Technology always seems to fail at the worst possible time					
5	Many new technologies have health or safety risks that are not discovered until people have used them (eye, back and wrist problems)					
6	Advanced technologies (e.g. 4IR) require extensive technological skills					

Insecurity: Tick each item as appropriate

	Statement	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
1	People are too dependent on technology to do things for themselves					
2	Too much technology (e.g. 4IR) distracts people to a point that is harmful					
3	Technology such as robots will lower the quality of relationships by reducing personal interactions					
4	The human touch is very important and advanced technology eliminates that factor					

5	When I do work I prefer talking to a person rather than interacting with an advanced automated system					
6	With new technology you need to check carefully that the system is not making mistakes					

SECTION 4: CHALLENGES

6. What are the challenges to the preparedness of the National Library of South Africa (NLSA), Pretoria, for the Fourth Industrial Revolution (4IR)? 4IR includes robots, Internet-of-Things, Big Data, 3D/4D printing, Artificial Intelligence, etc

	Statement	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
1	Inadequate Information Technology (IT) infrastructure					
2	Lack of innovative leaders					
3	Lack of adequate and sustainable funding					
4	Unstable electricity supply poses a challenge					
5	Resistance to change, inadequate skills and competencies					
6	Lack of exposure to international standards					

If other specify

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APPENDIX C: CERTIFICATE OF EDITING

UNIVERSITY OF LIMPOPO



Faculty: Humanities

Department: Languages and Communication Studies

Department: Languages

Private Bag X1106

Sovenga

0727

Tel: +27 15 268 3564

Cell: 073 597 4602

E-Mail: moffat.sebola@ul.ac.za

20 June 2023

TO WHOM IT MAY CONCERN

This letter serves to certify that I have edited a dissertation titled: **Investigating public libraries' preparedness for the 4IR: a case study of the NLSA, Pretoria** by **Mbalenhle Lucia Kekana**. A version of the manuscript with the evidence of my editorial and proofreading interventions has been forwarded to the author(s) and can also be provided by upon your request. I am confident that you will find the editing quality in order.

Best regards

[Redacted Signature]

[Redacted Name]

DR. MOFFAT SEBOLA

APPENDIX D: GATEKEPPERS LETTER



15 October 2021

National Librarian and CEO Mr Kepi Madumo
228 Johannes Ramokhoase (Proes) Street
Pretoria
0001

Dear: Sir

RE: Mbalenhle Kekana Masters Student at University of KwaZulu-Natal

My name is Mbalenhle Lucia Kekana I am a master's student (Information Studies) at the University of KwaZulu-Natal, South Africa. The title of my master's research is "Investigating public libraries' preparedness for the Fourth Industrial Revolution: a case study of the National Library of South Africa, Pretoria".

Given the above, I, therefore, seek the permission of the National Library of South Africa, Pretoria. I will need a letter of approval from you, to present to my University because UKZN ethical compliance regulations require me to provide proof that the relevant authority where the research is to be undertaken has given me the approval.

I appreciate your support and understanding to permit me to carry out my research in your esteemed library. If you need any further information, you may wish to contact my supervisor on the address below.

Thank you in advance for your understanding.

Yours Sincerely

Kekana ML

Email: mbalenhle.kekana0329@gmail.com

Tel no: 0796591747/0680926647

Dr Gbolahan Olasina(Supervisor)

University of KwaZulu Natal

School of Social Sciences

PMB campus

Pietermaritzburg

Email: olasinaG@ukzn.ac.za

Tel: +27 783735065

APPENDIX E: GATEKEEPERS APPROVAL LETTER



NATIONAL LIBRARY OF SOUTH AFRICA

Our Ref:
Research/permission

Your Ref: NLSA

Enquiries:
Lebogang.Matlala@nlsa.ac.za

15 February 2022

**Ms Mbalenhle Kekana
University of KwaZulu Natal
School of Social Sciences
PMB campus
Pietermaritzburg**

Dear Ms Kekana

PERMISSION TO CONDUCT RESEARCH ON THE NLSA

**You are hereby given permission to conduct a case study on the National Library of South Africa (NLSA).
Once the study is completed you are required to share the outcomes of your study with the NLSA.**

Thank you

**Signed by: Nokuthula Patricia Musa
Signed at: 2022-02-15 12:12:08 +02:00
Reason: I approve this document**



**Nokuthula Musa
Executive Director: Core Programmes
Tel: 012-401 9782
Nokuthula.Musa@nlsa.ac.za**

Pretoria (Head Office) 228 Johannes Ramokhoase(Proes) Street, Pretoria | Tel: +27 (0)12 401 9700
Cape Town Campus 5 Queen Victoria Street, Cape Town | Tel: +27 (0)21 424 6320

Board Of Directors: Mr Themba Thomas Cyril Dlamini (Board Chairperson), Mr Trevor Mokeyane, Ms Thuli Mokgele, Dr Buhle Mbambo-Thata, Ms Letlhogonolo Noge-Tungamirai, Ms Keke Madi, Ms Berenice Lue Marais, Mr Lufuno Nematswerani, Ms Leah Khumalo, Mr Kepi Madumo (Ex-Officio Member)

APPENDIX F: ETHICAL APPROVAL LETTER



22 February 2022

Mbalenhle Lucia Kekana (220078505)
School Of Social Sciences
Pietermaritzburg Campus

Dear ML Kekana,

Protocol reference number: HSSREC/00003751/2022

Project title: Investigating public libraries' preparedness for the Fourth Industrial Revolution: a case study of the National Library of South Africa, Pretoria

Degree: Masters

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 03 January 2022 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

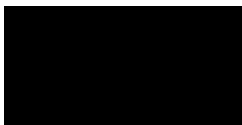
This approval is valid until 22 February 2023.

To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,



Professor Dipane Hlalele (Chair)

/dd

Humanities and Social Sciences Research Ethics Committee

Postal Address: Private Bag X54001, Durban, 4000, South Africa

Telephone: +27 (0)31 260 8350/4557/3587 Email: hssrec@ukzn.ac.za Website: <http://research.ukzn.ac.za/Research-Ethics>

Founding Campuses: ■ Edgewood ■ Howard College ■ Medical School ■ Pietermaritzburg ■ Westville

INSPIRING GREATNESS

APPENDIX G: INFORMED CONCENT

Informed Consent Document

Dear: Participant

My name is Mbalenhle Lucia Kekana I am a Master of Information Science candidate studying at the University of KwaZulu-Natal, Pietermaritzburg College Campus. The title of the research is: Investigating public libraries' preparedness for the Fourth Industrial Revolution: a case study of the National Library of South Africa, Pretoria.

The aim of the study is to investigate public libraries' (PLs) preparedness for 4IR using the lens of the National Library of South Africa, Pretoria. I am interested in interviewing and recording you so as to share your expertise on the subject matter.

Please note that:

- The information that you provide will be used for scholarly research only.
- Your participation is entirely voluntary. You have a choice to participate, not to participate or stop participating in the research. You will not be penalized for taking such an action.
- Your views in this interview will be presented anonymously. Neither your name nor identity will be disclosed in any form in the study.
- The interview will take about one hour.
- The record as well as other items associated with the interview will be held in a password-protected file accessible only to myself and my supervisors. After a period of 5 years, in line with the rules of the university, it will be disposed by shredding and burning.
- If you agree to participate please sign the declaration attached to this statement (a separate sheet will be provided for signatures)

I can be contacted at: School of Social Sciences, University of KwaZulu-Natal, Pietermaritzburg Campus, Scottsville, Pietermaritzburg. Email: mbalenhle.kekana0329@gmail.com; Cell: 0796591747/0680926647.

My supervisor is Dr Gobolahan Olasina who is located at the School of Social Sciences, Pietermaritzburg Campus of the University of KwaZulu-Natal. Contact details: email Olasina@ukzn.ac.za Phone number: 033260528.

The College of Humanities Research Ethics may be contacted at Humanities Research Ethics Office, University of KwaZulu-Natal. Contact details: email: HSSREC@ukzn.ac.za Phone number +2731 260 4557

Thank you for your contribution to this research.

DECLARATION

I..... hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire. I understand the intention of the research. I hereby agree to participate.

Signature of participant:

Date: